Artificial intelligence

in the public and private sectors

in Poland and Czech Republic

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REPORT

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Part III was created in collaboration with both teams.

Warsaw - Prague, December 2020

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Introduction

The potential of artificial intelligence is growing every day. At the beginning of this decade, the technological world had 25 times more data at its disposal than at the beginning of the previous one. This, along with the acceleration in the development of neural networks over the course of about 10 years, favours its further applications. Today, they are also used by the public and private sectors in the Czech Republic and Poland.

Both our countries have similar ambitions to use artificial intelligence to accelerate development, and thus make up the technological and economic gap that separates us from the rest of Western Europe. In this report, we look at these intentions, and try to assess how far the process has advanced and what else can be done to accelerate it.

In particular, we will analyse the importance of AI in the policies of both countries. The mechanisms of financing AI technologies and the degree of their use in the reform of the decision-making process by the state administration, the state of education and research, and the advancement of academia. Also, the impact of artificial intelligence on the labour market in Poland and the Czech Republic. We will also present examples of AI applications in both sectors, and the most interesting initiatives to fight the Covid-19 pandemic using AI.

The information collected by the authors from both countries is the result of extensive research and analysis, as it is not widely available. We used both "desk research" and in-depth interviews with entrepreneurs and representatives of public administration on the use of AI in their companies and institutions. We also tried to determine the scale of the implementation of AI systems and related challenges by surveying a group of 50 public institutions and 50 enterprises in each country. This work was undertaken over a 5-month period, during which we exchanged our findings and experiences with our partners from the Aspen Institute.

As a result, we present the following analysis to our readers, hoping that it will serve its recipients as a source of reflection and inspiration.

Foundation Centre for International Relations - project coordinator

Part I

AI in the Czech Republic

Chapter I

The policy of the Czech government towards artificial intelligence (AI)

"The Czech Republic has great potential to contribute to the prosperity and competitiveness of the EU as a whole. Our best traditions are in industry, defence, or security. We are the seventh safest country in the world, and our companies and developers have also succeeded in the area of protection from cyber-attacks. We are a safe cyber port in the heart of Europe. AI is at home here in the Czech Republic."

Prime Minister Andrej Babiš on Solair 2019 conference in Prague, focused on ethical and legal standards for AI.[1]

[1] https://www.vlada.cz/en/clenove-vlady/premier/speeches/prime-minister_s-speech-at-the-solair-2019-conference-176147/

The Czech Republic has an ambitious National AI Strategy

AI became one of the strategic topics of the Czech government in 2018, in response to the European Commission's "Artificial intelligence for Europe" initiative.[2] The need for a proactive approach to the deployment of AI technologies stems from the presumption that economic growth during the upcoming period will largely be fostered by the application of new technologies, with digital technologies and AI at the forefront. The anticipated disruptive impact of AI technologies on the labour market, is another reason why this topic is being addressed in the Czech Republic with such urgency of late. Given the structure of the Czech workforce, and the way in which the Czech Republic participates in global value chains, it will presumably be one of the countries whose occupational structure will be exposed to the greatest changes.[3,4] Not only the social security and retraining systems, but the entire process of education and lifelong learning will need to be adapted to such change.

Three strategic documents are of fundamental importance for AI development in the Czech Republic. Firstly, there is the Digitální Česko (*Digital Czechia*)[5] government program of 2018 which pertains to all the economic and societal impacts of digitization. It consists of a set of concepts setting forth the prerequisites for the Czech Republic's long-term prosperity. Its contents could be defined as a strategy for a coordinated and comprehensive digitization of the Czech Republic. Digitální Česko serves as an umbrella for three pillars (individual concepts) which forms a logical whole. The areas it covers range from the Czech Republic's interactions in the digital agenda in the EU, through digital public administration, to the preparation and interaction of the Czech society and economy in digitization.

[2] https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe

[3] https://www.mckinsey.com/~/media/mckinsey/featured%20insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works-Executive-summary.ashx

[4]. https://www.pwc.com/hu/hu/kiadvanyok/assets/pdf/impact_of_automation_on_jobs.pdf

[5] https://www.mvcr.cz/soubor/vladni-program-digitalizace-ceske-republiky-2018-digitalni-cesko-uvodni-dokument.aspx

The second important document is the Inovační strategie České republiky 2019-2030 (*Innovation Strategy of the Czech Republic 2019-2030*);[6] its nine pillars include *inter alia* the digital state, manufacturing and services. The strategy summarizes the current state of affairs in each of its pillars and contains the main objectives and framework tools designed for their attainment.

Nevertheless, the most important strategic document in terms of AI development is the Národní strategie umělé inteligence v České republice (*National AI Strategy* - NAIS)[7] of 2019. NAIS works with the assumption that the current trends of artificial intelligence, automation and robotics, and related trends, such as electromobility, data economy or 5G networks, are essential for further development of the industry, services and economy as a whole. NAIS's main horizontal objectives thus far are to use these state-of-the-art technologies to move the Czech Republic forward towards an innovation economy, to support domestic companies and to further economic growth. To boost the safety and certainty of the population, increase its day to day comfort and ensure swift, efficient and forthcoming communication with the state. The overall goal then is to bring the Czech Republic back among the most developed countries of the world.

To that end, NAIS defines specific key measures in the following areas:

- Promotion and concentration of science, research, and development
- Financing research and development, investment support and the development of the AI ecosystem in the Czech Republic
- AI in industry, services, and public administration
- Human capital and the education system together with lifelong learning
- Measures to address the impacts of AI on the labour market and the social system

[6] https://www.vlada.cz/assets/urad-vlady/poskytovani-informaci/poskytnute-informace-na-zadost/Priloha_1_Inovacni-strategie.pdf

[7] https://www.vlada.cz/assets/evropske-zalezitosti/umela-inteligence/NAIS_kveten_2019.pdf

- Legal and societal aspects of AI, ethical rules, consumer protection and security issues
- International cooperation

The Ministry of Industry and Trade plays the main coordinating role in the implementation of this strategy.

To be effective, it is essential to support the concentration of excellent R&D in AI, in particular by supporting the creation of the European Centre of Excellence, Test Centre and Digital Innovation Hubs. Together with deepening cooperation with global AI centres, as well as maintaining top level research and retaining experts in the Czech Republic, along with simplifying conditions for the arrival of top foreign talent and making them more appealing. It is therefore essential to procure funding for research, the development of start-ups and the entire AI ecosystem, to facilitate know-how transfer and to increase the availability of resources for SME innovation. The economy is the driving force behind digital and AI transformation, and it is thus necessary to create conditions for its development. The state can contribute to this end in particular by making data available, completing the digital infrastructure, supporting the transformation of enterprises and introducing modern public administration services.

Education, training, and retraining, both in technical disciplines and in humanities, play a crucial role in the NAIS, and focus is needed on the skills which will be necessary in the upcoming decades. The training of human capital is of key importance with a view to the impacts of AI and automation on the labour market and employment. However, the social system also needs to be prepared for a quick and flexible response. NAIS further attributes an extraordinary role in AI development to legislation conducive to AI development, while guaranteeing the protection of fundamental rights and security, as well as legal certainty for investors. The development of international cooperation and the Czech Republic's involvement, especially at an EU level, also plays an indispensable role in the utilization of global trends.

Regulatory framework is catching up with reality

Regulatory framework development is one of the key conditions for successful AI development in the Czech Republic. It has the potential to significantly contribute to increasing the competitiveness of the Czech Republic by providing legal certainty and removing regulatory barriers to the development and utilization of AI. Czech law is limited by its dependency on developments in international, and especially, European law, and by the unpredictability of AI utilization and its actual social consequences.

In the process of preparation of the National AI Strategy, an analysis of legal and ethical aspects of AI development and AI applications in the Czech Republic was drawn up.[8] In the field of ethics, the study focuses in particular on a general description of current trends in the approach to ethical problems associated with AI, identification of key ethical problems, and formulation of recommendations which may extend to legal regulation. In terms of the law, and given the universal applicability of AI in many areas, several general legal areas have been identified. These include the status and legal nature of AI, liability, privacy protection, electronic communications, cybersecurity or IP protection, and several specific legal areas, including for instance the financial sector, antitrust, research and development, social security, autonomous mobility, or autonomous weapons.

It can be said with a view to individual findings, that current regulations in certain areas are sufficiently flexible, and thus can be applied by analogy in the field of AI. However, this status is unsustainable for instance in the area of liability for damage because of growing interlinkages between the systems and their complexity, there for a new solution will need to be found. That, however, will depend on the pan-European solution of liability for damage that is currently being analysed and researched. There is some degree of uncertainty at present due to unpredictable results in the application of current legislation to new issues. Such legal uncertainty might however be further aggravated by non-conceptual legislative changes. In the future, barriers to effective data sharing and processing in AI

[8] https://www.vlada.cz/assets/evropske-zalezitosti/aktualne/AI-pravne-eticka-zprava-2018_final.pdf

development and its utilization will need to be removed. If AI development is not continuously monitored and subsequently reflected in legal regulations, the Czech Republic might find itself lagging behind global developments. On the other hand, AI offers many opportunities, with the legal sphere included. The industry ought to contribute to development by designing self-regulatory mechanisms which would be tailored to its needs, yet still comply with the law. The formulation of best practices can contribute to the development of specialized consultancy and the creation of special know-how. Technical solutions conducive to effective operation of the law ("regtech") can also be developed. Yet another option is the creation of flexible models of "regulatory sandboxes" (i.e., protected environments supervised by the regulator, in which AI research and development would be conducted) and data trusts containing data not subject to legal restrictions for the training of intelligent systems and the development of new applications. →

Chapter II

The state of advancement of scientific research and education on AI in the Czech Republic

Application-driven research

The research and development of artificial intelligence in the Czech Republic is being carried out by a broad spectrum of public research institutions. The primary locations are the eight major academic research centres that focus on topics relevant to AI and cover both basic research and applied R&D. These centres are distributed across the major universities in the country: Czech Academy of Sciences, Charles University, Czech Technical University in Prague, Brno University of Technology, Masaryk University, University of West Bohemia, Technical University of Liberec, and Technical University of Ostrava. The broad geography of the locations prevents the localization of research in one specific region and enables more equal and balanced access to the know-how across the country.

Most of the research in the field of artificial intelligence carried out in the Czech Republic is application-driven. The research topics and the areas of expertise include natural language processing, computer vision and intelligent robotics, as well as the complementary fields such as cybersecurity and high-performance computing. The vast majority of the AI-related projects are dealing with the widely used AI methods, i.e. statistical learning methods and machine learning, including neural networks.

The Czech Institute of Informatics, Robotics and Cybernetics, part of the Czech Technical University in Prague (CIIRC CTU), is also putting an extra focus on basic research, on top of the applied AI. The European Centre of Excellence for Industrial Robotics and Artificial Intelligence - RICAIP is being created at CIIRC. Together with its partners in the Czech Republic and Germany, CIIRC plans to strengthen its role in artificial intelligence and robotics research for

advanced industrial production in Europe.[9] A special research group that seeks to develop a system to gradually develop strong artificial intelligence (so-called strong artificial intelligence) was created in 2019 and is led by Tomáš Mikolov, an internationally respected researcher in artificial intelligence and specifically in the field of natural language processing, who used to carry out his research work at Facebook AI Research. The field of strong AI and the goal of advancing the AI algorithms has also been pursued by a private Czech research company, GoodAI, which is supporting Mikolov's research with a private grant.[10]

"In the future, I would like to see that we will support more basic research [in the field of AI] in the Czech Republic, where we do not try to incrementally improve an existing application, or implement a technique that was invented abroad. On the contrary, we should take on the role of pioneers in new research directions, and the results of this work can be further used in our country" - says Tomáš Mikolov.

The support of the European Structural and Investment Funds (ESIF) and additional public resources have enabled the recent creation of the supportive research infrastructure for the area of artificial intelligence. In the Operational Programmes (OP) framework such as the RDI OP, RDE OP4 as well as the complementary national programs, a number of new application-focused AI centres were created in order to facilitate the transfer of the research results to the application sphere. Over the last years, that includes the Czech Technical University (CTU) Research Centre for Informatics (RCI) in Prague, the Czech Institute of Computer Science, Robotics and Cybernetics (CIIRC) at the CTU, and New Technologies for the Information Society (NTIS) in Pilsen, West Bohemia. A current benchmark for interlinking academic research, education and the private sector is the AI Centre of the Electrotechnical Faculty at

[9] https://www.ciirc.cvut.cz/svetove-uznavany-expert-tomas-mikolov-prichazi-z-facebook-ai-do-ciirc-cvut-zameri-se-na-vyvoj-silne-umele-inteligence/

[10] https://www.ciirc.cvut.cz/cs/goodai-grant-for-mikolov/

the CTU under the leadership of prof. Pechoucek.[11] Currently working on 10+ R&D projects in both basic and application domains, this team of 48 students, researchers and academics are currently focusing on multiagent systems and collective AI, automated planning and decision-making, algorithmic game theory, as well as cybersecurity. At the same time, AI Centre offers a range of R&D-related services both to private and public entities, including contractual research, consultancy, training, IP co-creation and project partnering.

Czech Republic: a new centre of AI excellence

May 2019 marked the launch of prg.ai, an ambitious initiative that aims to develop Prague as an AI super hub and help the Czech Republic become a major AI centre of excellence in Europe. The initiative was founded by The Czech Technical University and united it with Charles University, Czech Academy of Sciences, and the City of Prague. It is supported by international companies, such as IBM, CISCO, Microsoft, Avast, as well as an extremely broad range of local start-ups and venture capital companies. “We are building an organization whose mission is to serve as a generator and a catalyst of initiatives and measures that will be instrumental in building a vibrant AI ecosystem in our region, developing bright talent, supporting excellent R&D, exploiting promising technological and commercial opportunities, playing an active role in policy-making and raising informed awareness of AI among the general public.” - explains Lenka Kučerová, managing director of prg.ai.

The initiative aims to build on the great academics and industry already present in Prague, and Prague’s sixth position in Europe by the AI jobs per capita closely behind Paris and Berlin. Its tangible and measurable goals for the upcoming 5 years are:

- Increase the AI jobs in Prague to 5000
- See at least 500 new AI graduates each year in the Czech Republic

[11] http://aic.fel.cvut.cz/

- Develop 50 new AI-based start-ups each year
- Raise 50 million of investment each year

Czech AI scene is actively supporting its female members, too. Czech Women in AI (CWAI) is a networking initiative launched in October 2020 in cooperation with the U.S. Embassy in Prague. The aim of CWAI is to enable Czech women active in the field of artificial intelligence to network, share ideas and experience, cooperate and inspire others to get involved in the field of artificial intelligence. The network is also planning outreach activities to get more women and young girls interested in the technology.

In the private sector, there are a number of regular activities that promote the practical use of artificial intelligence, as well as showcase examples of successful implementation. Organized by a private entity with the support of the media and corporate partners, Machine Learning Prague is the largest European event on the practical use of artificial intelligence and machine learning, attracting capacities from all over the world to Prague. In 2020, it announced the merger with AI Awards - an initiative for endorsing successful professionals and companies that are setting the direction for the global trend in the development of artificial intelligence technologies. The goal of the AI Awards competition organized by the publishing house Economia, together with Accenture, Avast, and Microsoft, is to raise public awareness and highlight innovative companies and individuals focusing on artificial intelligence. The second year of the competition took place online, and featured the winners from several categories, such as AI Personality of the Year, AI Start-up of the Year, or AI Event of the Year. A category that deserves special attention is Special Award for Visibility of the Czech Republic in the AI World, which encourages the international popularisation of the state-of-the-art artificial intelligence technologies from the Czech Republic.[12]

[12] https://www.aiawards.cz/

It is not just about the R&D

Additionally to scientific research in the field, the scene of AI in the Czech Republic is witnessing a growing attention to complementary areas, such as AI policy and safety.

In 2021 (postponed from 2020 due to COVID-19), the City of Prague is to host the 1st International Congress for the Governance of AI (ICGAI), in partnership with the Carnegie Council for Ethics in International Affairs and the World Technology Network. ICGAI is a collaborative initiative directed at establishing an agile and comprehensive governance framework for artificial intelligence. It aims to bring together representatives of governments, industry, international organizations, universities, research centres, leaders of underserved nations and communities, and other stakeholders in the AI space with the ambition of balancing the need for innovation, competition and cooperation, while minimizing risks and undesirable societal consequences. Remarkably, the goal stated by ICGAI is the development of a specific hands-on framework that will accommodate input from the various stakeholders and "function as a trusted good-faith broker, monitor developments, flag concerns and explore creative means to manage issues through engineering, ethics, and/or oversight".[13] This distinguishes ICGAI from a number of discussion platforms and events held on the topic before, and can indicate the progress towards the more practical and actionable approach to the AI-related disciplines.

Another remarkable initiative is the international conference SOLAIR (Society, Law, Artificial Intelligence and Robotics), organized by the Institute of State and Law of the Academy of Sciences of the Czech Republic and under the auspices of the Ministry of Industry and Trade. After a successful launch in 2018, the second edition has established regularity of this discussion platform for human-centric artificial intelligence, while the 2020 online edition focused mainly on the issue of fundamental values and rights in the digital age. Human-centric AI is based on respect for fundamental human rights and values, such as the right to privacy, dignity, and human autonomy. The European

[13] https://www.icgai.org/

Commission's High-Level Expert Group on Artificial Intelligence has marked the beginning of the work towards the principles of human-centric AI in June 2018, and the Czech Republic has been actively addressing the relevant questions since on SOLAIR's platform. The aim of SOLAIR, organized under the auspices of the Prime Minister of the Czech Republic, the Minister of Industry and Trade of the Czech Republic and the President of the Czech Academy of Sciences, is to provide space for discussions on the responsible development of AI, and to raise public awareness about important issues related to social aspects of this powerful technology. The 2019 edition featured discussions around the Ethics Guidelines for Trustworthy AI as well as Policy and Investment Recommendations drafted by the High-Level Expert Group on Artificial Intelligence in 2019. Also, a business perspective on ethical issues and the future of AI, discussion of a non-paper on desirable future regulation of AI on the EU level and discussions about the future international approach to regulating AI on various levels. Special attention was given to the specific legal topics related to AI, such as liability, setting up legal standards for AI, autonomous mobility, compulsory licenses.

All in all, we can see that the Czech Republic is actively contributing to the area of human-centric and ethically responsible AI development, as well as accepting the latest best practices in its own developmental processes and raising public awareness on the matter. →

Chapter III

AI technology financing mechanism in the public and private sector of the Czech Republic

AI innovation supported by both public and private sector

The higher education sector is receiving approximately 70 % of the state support towards the R&D in AI, and the majority of the remainder is being directed into the private sector. About two-thirds of the state support is directed towards the applied R&D and the most supported field is the manufacturing industry. [14]

The targeted support of the R&D in AI has grown in the past ten years significantly not only in the public sector, but also in the private. The private R&D expenditure has increased over the decade moderately from approximately 20 % of the total AI R&D expenditure by approximately 10 percentage points. While in 2015, the private sector contribution to the total costs of artificial intelligence R&D projects has accounted for less than 20%, in the following years their share has exceeded 30% of the total costs of the finished projects. This trend, if continued, could possibly demonstrate **the power of positive impact of state support on the mobilization of private resources for AI R&D.**

However, according to the recent evaluation of the Technology Centre CAS, despite the robust growth of AI R&D in the past years, the targeted support suffers from fragmentation: “It currently depends on the R&D programs managed by government departments (ministries) which have been originally conceived with different objectives, and

[14] Artificial Intelligence - where does the public support of R&D in the Czech Republic go and what are its results? https://www.strast.cz/en/publications/artificial-intelligence-where-does-the-public-support-of-r-d-in

on generic programs of the national grant agencies. It turns out as well, that a significant fraction of projects were in particular areas where the current state of AI approaches human capabilities and thus the potential for disruptive innovations has been depleted".[15] The proposed next step for the successful harnessing of AI is to set up a specific research program for both the basic and applied AI research within the recently adopted National AI Strategy of the Czech Republic. →

[15] same

Chapter IV

Examples of the use of artificial intelligence in the public sector

Data evaluation and diagnostics in medicine

General University Hospital in Prague

A modern hospital represents a complex mechanism offering many opportunities for a meaningful use of modern information technologies and artificial intelligence. One of the largest hospitals in Prague has therefore been cooperating with Microsoft on a research project concerning the utilization of artificial intelligence in the health care sector for an extended period of time.

The first step in this direction was the hospital management's 2018 decision on cloud migration of data and data services (using the Microsoft 365 Enterprise platform). As a result, hospital staff gained round-the-clock access to a uniform data and communication platform for teamwork anywhere and using any end device.

Consolidation of data in the cloud subsequently permitted the deployment of AI tools for the analysis of large amounts of data and its utilization for the management of the operation of the hospital (on the machine learning Microsoft Azure and Microsoft Cortana Intelligence Suite platform). The hospital now analyses its entire logistics, costs, circulation of medicinal products and drugs better. It is for instance able to assess suppliers or plan the duration of hospital stays depending on the diagnosis made and the severity of serious complications after various surgeries.

The utilization of AI to improve the diagnostic process is another step. In the first phase, physicians focused on the analysis of radiological images of patients with prostate cancer. They used the Microsoft Project InnerEye tool, which performs an automated quantitative analysis of 3D radiological analysis by means of machine learning technology. While a qualified oncologist needs between 30 minutes and 4 hours for a traditional radiological examination, depending on the cancer type, artificial intelligence is able to perform the analysis in several minutes. The diagnosis must naturally be ultimately approved by the physician, but the entire process is much shorter than before. Other tested tasks included for instance, radiotherapy planning, which involves a high precision delineation of target areas, i.e., the area to be irradiated needs to be marked for the irradiator with precision so that the dosage directed at the affected area can be maximized and damage to healthy tissues minimized.

Helping to prevent decubitus

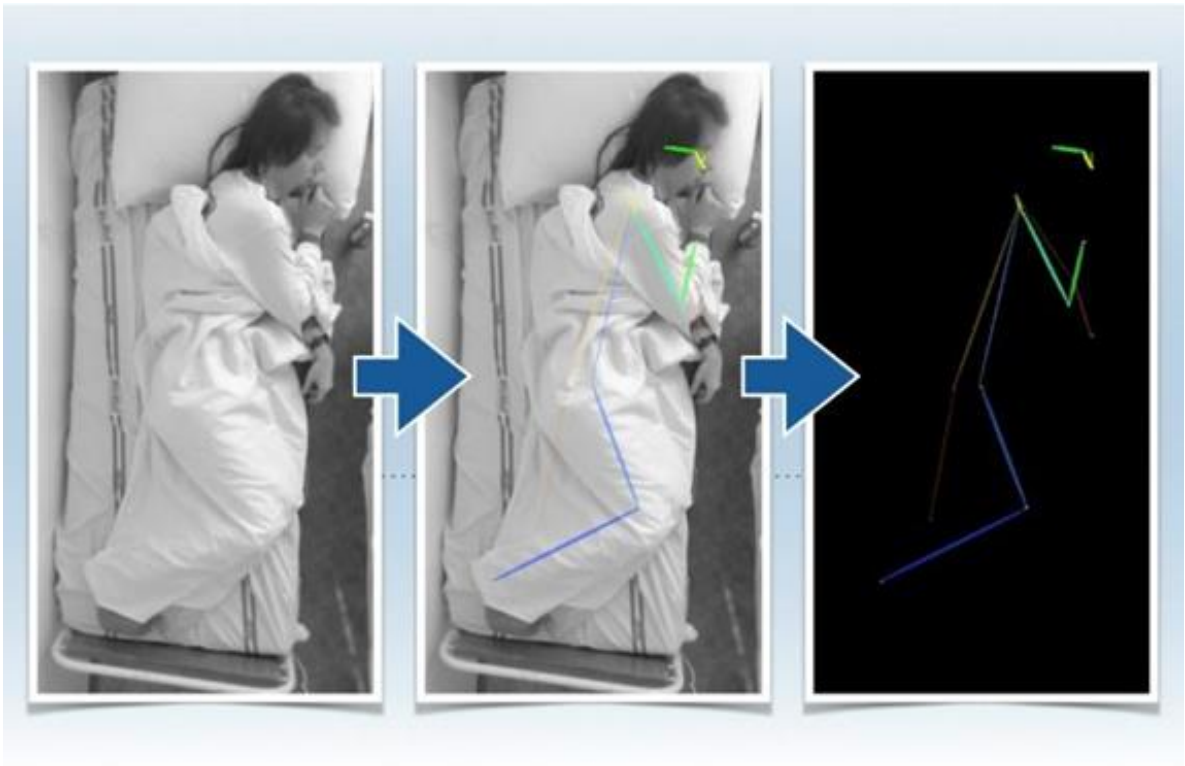
Na Bulovce Hospital in Prague

Decubitus, also known as bedsores, are a serious problem in the health care sector. Na Bulovce Hospital and GoodAI carried out pilot tests which show that image analysis on AI basis can be used to help prevent decubitus. The project employs deep learning methods to predict the likelihood of decubitus occurrence in patients and enables the care staff to adopt preventative measures.[16]

Pilot tests have already been performed at Na Bulovce Hospital using AI-based image analysis in order to recognize and monitor the positions of individual patients. The patient position records can be used to assess the risk of patients developing decubitus or falling out of beds. The solution would subsequently be able to alert the care staff to patients at risk, and help health care professionals determine efficient intervals and procedures for patient positioning and set them forth in the care manual.

[16] http://bulovka.cz/umela-inteligence-muze-pomoci-v-prevenci-dekubitu/

Following the successful pilot tests, the GoodAI team is currently looking for health care organizations, innovative hospitals, care homes or nursing homes in order to work with them on further research and development of the technology.



GoodAI

Nemocnice Na Bulovce

AI involvement in emergency call receipt

Ministry of Interior of the Czech Republic

The Ministry of Interior has launched a project designed to determine whether AI elements could be used in connection with emergency calls. Domestic companies, GoodAI Applied, Phonexia and SpeechTech, as well as the Faculty of Information Technology of Brno University of Technology and VSB - Technical University of Ostrava, are also working on the solution.

The project examines the deployment of artificial intelligence in the receipt of emergency calls during extraordinary events using a voice chatbot. A shift in speech analysis, semantic analysis, dialogue management and voice synthesis, including geographic information integration, is expected to occur. The project is expected to result in a functional demonstrator working with real phone calls in conditions approximating deployment in the Integrated Rescue System (IZS) and recommendations for the integration of the system and its further development towards IZS automation.

Czech companies participating in the project, have technologies already tested at their disposal. GoodAI Applied has been developing its own chatbot based on algorithms of natural language processing (NLP) since 2017. Phonexia has long been known in the area of speech recognition technologies, and SpeechTech focuses in particular on speech to text conversion and vice versa. The Faculty of Information Technology at Brno University of Technology will participate mainly through its Speech@FIT research group which focuses on speaker and language identification, speech recognition and keyword tracking, and VSB has a supercomputer centre, IT4Innovations, at its disposal.

Identification of perpetrators of crimes

Czech Police

Artificial intelligence can establish the approximate age, gender and language from a voice recording in a matter of seconds. It thus helps the police to sort through hundreds of recordings of fraudsters who ordered mobile phones or took out microloans over the phone. Scientists from the Brno University of Technology in collaboration with Phonexia are developing a special program for this purpose.

Using a large quantity of audio recordings of known speakers, the program is able to train itself to an extent where it can recognize which recordings of unknown speakers relate to a particular known speaker. It is also possible to establish the speaker's physical appearance from the recording: how long the speaker's larynx is, the position of their teeth, the function of their tongue, hard and soft palate, sinuses. This is unique to each speaker, and their 'voiceprint' is therefore as unique as a fingerprint. The scientists have been trying to experiment with AI even further and would like to put together the likeness of a person based on their voice. However, for a program to be able to draw somebody's face with precision on the basis of a five second bomb threat call still remains in the realm of science fiction.

Criminologists have been using the program in particular for recordings made by credit companies providing loans. Where the borrower does not pay as and when due, the police start investigating upon notice. The police make a tentative identification of the perpetrator and refer the case to criminologists who compare recordings of known persons with recordings of unknown persons.

A tool for combating drugs

Czech Police

Czech criminologists have invented a unique database which can compare the way drugs are packaged to similar cases anywhere in the world in seconds. Thanks to this system known as RELIEF, it is easier for the police to identify the mafia behind a particular drug case. [17]

This comparative method is based on a scientific examination of every drug package intercepted. Analysts first carefully examine the chemical composition or packaging style - for instance, how the drug is compacted or what stamping die was used by the manufacturer. Each package thus displays unique features which could be compared to human fingerprints. These features are fed into an electronic system, the database performs an automated comparison and is able to identify the country of origin with precision. The police then trace the routes along which the drugs are smuggled by couriers.

The RELIEF system, became an official evidentiary method in the Czech Republic as early as 2010. Other countries gradually joined the project, and in 2019, the Czech Republic officially donated the RELIEF international database to Interpol. Interpol scored a number of successes in its war against drugs and uncovered a network of traffickers smuggling large deliveries to various European countries. The RELIEF system currently helps to find the place of origin of the drugs using AI methods. This greatly complicates their distribution to their end destinations, including the Czech Republic.

[17] https://www.mvcr.cz/clanek/projekt-relief.aspx

Automatic support for studies planning

University of West Bohemia

The University of West Bohemia in Pilsen, prepared AI algorithms for the U.S. company Owen Software, allowing them to plan education and professional careers. The algorithm automatically evaluates to what extent the subjects and courses listed by various schools are similar in terms of the content and levels. For example, at the listed language courses, it was possible to determine if the same language is taught, if it is about the same type of teaching, and how the levels of difficulty match.

The know-how consists not in the keyword search, but in an understanding of the natural content of the text. The algorithm understands the content of the text so that it is able to assess the conformity of the subjects and courses on a scale from 0% to 100% with a success rate comparable to that of a human.

Why is it a difficult task? The information searched is generally available on the Internet. But it is coded in a natural language without prescribed structure, and there is a huge amount of it. For example, in the USA there are approximately 420,000 job offers, 80,000 traineeships, 47,000 vocational schools and universities, 15,000 possibilities to study financing. For this reason, the AI algorithms for neuro-linguistic programming (NLP methods) were used, which were then implemented by Owen Software into the final product Pathevo[18].

[18] http://nlp.kiv.zcu.cz/projects/pathevo

Chapter V

Examples of the use of artificial intelligence in the private sector

Anti-fraud and fintech

Company: Resistant AI

Resistant AI aims to protect AI systems from targeted manipulation, adversarial machine learning attacks and advanced fraud.

The system is based on a robust collection of machine learning models that represent the behaviour of document issuers (such as banks or payroll companies). It also models financial software, software libraries and even individual devices such as scanners or mobile phones. The system continuously learns and improves its detection performance with each document it assesses, both legitimate or malicious. Each document flagged by the system is justified by human-readable risk indicators presented to the fraud analyst. “Companies are just now learning how to deploy AI,” said Resistant AI co-founder and CEO Martin Rehak. “And on the other side, we see criminals and fraudsters learning how to use those processes for their benefit and how to steal money at scale. Our job is to protect the AI and machine learning models.”[19]

[19] https://venturebeat.com/2020/04/30/resistant-ai-raises-2-75-million-to-protect-algorithms-from-adversarial-attacks/

Resistant AI's team includes a core group that worked for the start-up, Cognitive Security, which was acquired by Cisco Systems in 2013.

Company: ThreatMark

ThreatMark is a fraud prevention service company (FPaaS) that provides real-time recognition of legitimate customers solutions. Their software determines whether the users are legitimate or fraudulent by detecting discrepancies in the behaviour of Internet application users. It primarily focuses on banks, specifically on internet banking, which is an area of extreme interest to cybercriminals. The unique technological solution works on computers and mobile devices and works with hundreds of variables: from classic parameters in the form of location and type of device, through the usual steps of the user in the application, to behavioural biometrics. For example, it evaluates how fast the user types on the keyboard, how he moves the mouse or how intensely he moves his finger on the touch screen.

The company's main advantage is that it offers banks comprehensive anti-fraud solutions in the online world - from threat detection and fraudulent transactions to identity validation. Its founder and CEO Michal Tresner, has been selected as EY Technological Entrepreneur of The Year 2019 by EY Czech Republic.

Robotic process automation

Company: Rossum

Rossum's artificial intelligence understands complex structured documents, enabling companies to capture data from financial documents efficiently and with human-level accuracy. Unlike existing text mining solutions, Rossum's unique deep neural networks reflect the way humans read documents. This eliminates the need for costly manual implementation.

It now primarily helps clients with the processing of invoices or delivery notes, however, it can also be used for other documents and across segments such as accounting, logistics or real estate management. Rossum technology has

an accuracy of around 98% in Czech language, which is about 3-5% better than a possible human result under certain conditions, according to the company's CEO Tomas Gogar. [20]

"Rossum is probably the fastest learning company we have ever helped build. Interest in their product and solution concept from large companies from all over the world confirms that even Prague can create extraordinary technology with global potential" - comments Tomáš Matějček from the investment fund Miton.[21]

Asset management, manufacturing & infrastructure

Company: GoodAI Solutions

A sister company of GoodAI, a research group of AI scientists, engineers, and consultants in the field of artificial general intelligence research. Their Pipe Leaks Prediction AI framework calculates the quality of the pipeline (probability of leakage) using a machine learning method. Using GoodAI Solutions framework, the Distribution System Operator can save substantial resources on CAPEX - avoiding the replacement of pipelines which can stay in operation in the following years, and OPEX - prioritizing replacement of pipelines with a high probability of leakages, so that resources are not wasted on fixing gas or oil leakages in the future. The framework also increases the safety in the network and adds visibility for the stakeholders on the cost and risk of their ageing network.

This new way of assessing the data allows asset managers, financial planners, and executive management to make better, more accurate, and cost-saving decisions for the renovating and fixing policies with 20%-30% savings on inspection and replacement costs.

[20] https://forbes.cz/cesky-rossum-cte-faktury-lepe-nez-lide-ted-ziskava-investici-81-milionu-korun/

[21] https://forbes.cz/cesky-rossum-cte-faktury-lepe-nez-lide-ted-ziskava-investici-81-milionu-korun/

FMCG and retail

Company: DataSentics

DataSentics is a machine learning studio that builds machine learning solutions for larger companies (banks / insurance companies, retail, large e-commerce players) and start-ups both in the Czech Republic and across Europe.

DataSentics is the largest purely machine learning studio in the Czech Republic and possibly in Central Europe. In Prague and Brno, you will find 60 experienced developers, mathematicians and architects who build machine learning solutions for larger companies (banks / insurance companies, retail, large e-commerce players) as well as start-ups both in the Czech Republic and across Europe.

Shelf Inspector is a simple-to-use retail visual check tool to enable brands to take control of how their products are actually promoted in stores, their (and even competitors) performance. It helps brands track the location of their products on hypermarket shelves using state-of-the-art Computer Vision, detect missing flavours, unpacked cans, and wrong rotation. The solutions also offers up-to-date shelf reporting. Results and hints are easily visualized within dashboards. →

Chapter VI

The impact of artificial intelligence on the labour market in the Czech Republic

AI-driven labour market transformation to increase inequality

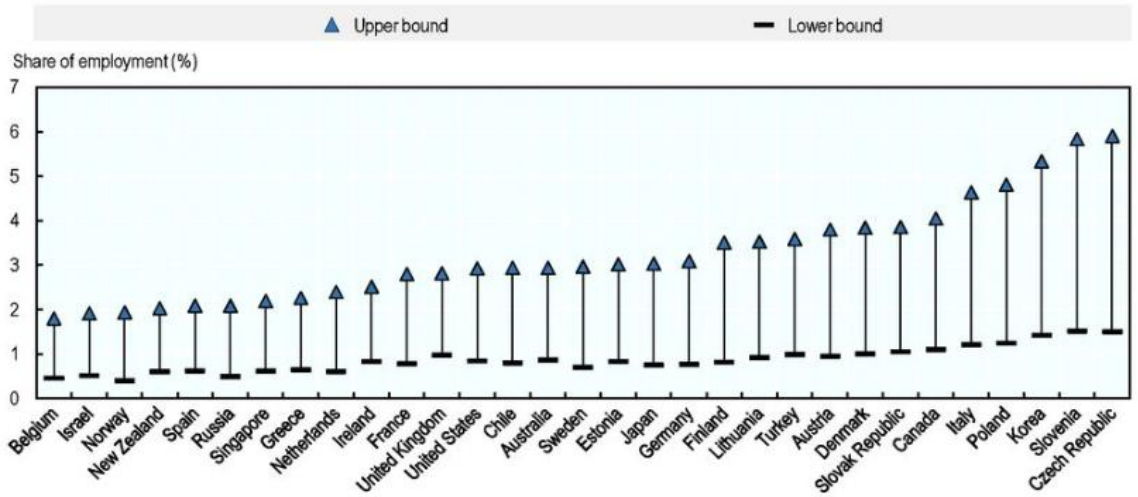
The Czech Republic belongs among the countries with the greatest expected impact of automation and technology using AI, particularly in areas such as manufacturing, retail trade, wholesale trade, health care and social services, education and construction. Technologies will increasingly perform routine activities, with the scope of work by employees being focused more on creative problem solving. Based on the high proportion of the manual labour market, it can be expected that automation will have a substantial impact in the Czech Republic on employment and jobs, while in other countries the automation will have a greater impact on productivity, safety and quality. According to the 2019 OECD report Skills Outlook[22], up to six percent of Czech employees will have to change professions in the near future. These are mainly employees in the energy, mining and construction industries, and farmers. They are most affected by the danger of labour market change, and it will be difficult for them to find alternative employment.

Among the other countries affected by a similar situation are Slovenia and South Korea. Poland comes forth, with the potential risk estimated to be at 5%.

[22] https://read.oecd-ilibrary.org/education/oecd-skills-outlook-2019

Digitalization is not, however, only taking manual jobs away while creating new, more specialized positions, it is also transforming the content and requirements for most of the jobs on the market. It is essential to increase the quality of human resources so that there are employees able to work with the new technologies and understand the basics of its operation, even if their position is not directly connected to it. As to the structural changes in the job market, it is unusual that the workers at risk know about the upcoming change well in advance and receive enough upskilling support.

Figure 3.13. Share of employment in occupations at high risk of automation for which an important training effort is needed to transition to occupations at low or medium risk of automation



Note: For the lower bound estimate, only workers in jobs currently at high risk of automation are considered while for the upper bound estimate, all workers currently employed in occupations at high risk of automation are considered. The proportion of workers in jobs at high risk of automation in an occupation is taken from Nedelkoska and Quintini (2018[9]). The risk of automation of the occupation of origin is computed based on estimates by Frey and Osborne (2017[10]). Those aspects are described in Box 3.4.
Sources: Authors' own calculations based on OECD (2012[6]) and OECD (2015[7]), *Survey of Adult Skills (PIAAC)*, www.oecd.org/skills/piaac/publicdataandanalysis.

StatLink https://doi.org/10.1787/888933973589

As the involvement of artificial intelligence in the day-to-day running of companies grows, company leaders are becoming increasingly aware of the need to improve their own expertise. According to the survey AI Pulse conducted by Microsoft, 68% of Czech managers and business leaders would welcome some form of support and further education for the development of skills associated with the deployment of AI. However, the results of the survey show that only 23% of Czech leaders perceive it as important to increase the qualifications of their existing employees.[23] This is the least of the 13 countries surveyed, where the average is at about 40%. Thus, there is a certain contradiction in place. While Czech leaders are well aware of the need for further education in the field of AI, they no longer perceive it so strongly among their own employees.

Meanwhile, even though digital transformation offers a lucrative opportunity, OECD emphasizes a significant risk of growing inequalities for certain countries, including the Czech Republic.[24] It therefore advises the early preparation of suitable opportunities for retraining and further education. According to the OECD report, three basic skills will be key for the new labour market: high levels of media and Internet literacy, effective use of the Internet, and last but not least, high language and numeracy levels.

The expert discussion on this topic held by Aspen Institute CEE in September 2020 showed that there is a lack of a unified platform for addressing the availability of lifelong learning in the Czech Republic.[25] The participants in the discussion agreed that it would be desirable to create a platform in which representatives of the state, business, educational institutions and academia would jointly determine what educational content needs to be created, what professional skills are relevant and the prospects for future employment. for individual professions. →

[23] https://news.microsoft.com/cs-cz/2019/09/17/rozvoj-umele-inteligence-zvysi-duraz-na-vzdelavani-zamestnancu/

[24] https://read.oecd-ilibrary.org/education/oecd-skills-outlook-2019

[25] https://www.aspeninstitutece.org/news-article/celozivotni-zvysovani-kvalifikace-se-musi-stat-spolecenskou-prioritou/

Chapter VII

Artificial intelligence systems in the fight against Covid-19

2020 has been a significant year due to the outbreak of COVID-19. The pandemic poses a number of challenges to the Artificial Intelligence (AI) Community, including, but not limited to the possibility of using AI for social control, treatment research, making diagnoses and prognoses.

A number of promising initiatives worldwide have been started to gather and share data - both existing and new data, and to train new AI models. These include the World Health Organization's (WHO) Global Research on Coronavirus Disease Database, which also provides links to other similar initiatives. The Czech Republic has a very active community of data scientists and technology specialists, who have demonstrated an outstanding ability to mobilize and cooperate in order to contribute to the nationwide fight against the pandemic. Some of the most interesting examples are listed in this chapter.

CaverDock

A team of researchers from Loschmidt Laboratory of the Faculty of Science, Department of Computer Science, RECETOX Research Center of Masaryk University (MU) and the International Center for Clinical Research of the University Hospital of St. Anna in Brno (FNUSA-ICRC) have dedicated their efforts into using the power of artificial intelligence to find a cure for the coronavirus. They leverage the ability of AI technology to work with large sets of data over short periods of time and try to look for correlations among the existing research results. "With the help of a special program, Caver Dock, a team of researchers from Masaryk University tested over four thousand previously approved drugs. In a vast amount of data, scientists have been able to find several molecules that could prevent the virus from spreading in the human body. In addition, the knowledge gained could now accelerate the development of a new drug. "[26]

[26] Umělá inteligence pomáhá v boji proti nemoci COVID-19

IT: enthusiasts and private sector to help the state

COVID19CZ initiative (internationally covidhacks.org) is a joint activity of Czech technology companies and IT enthusiasts focused on helping in the fight against COVID-19 infection. The purpose of the activity is to offer modern technologies as well as assistance with communication where they can facilitate the fight against a viral infection, either by making information available or by data analysis facilitating the detection of outbreaks.

Some of its data-driven projects are listed below:

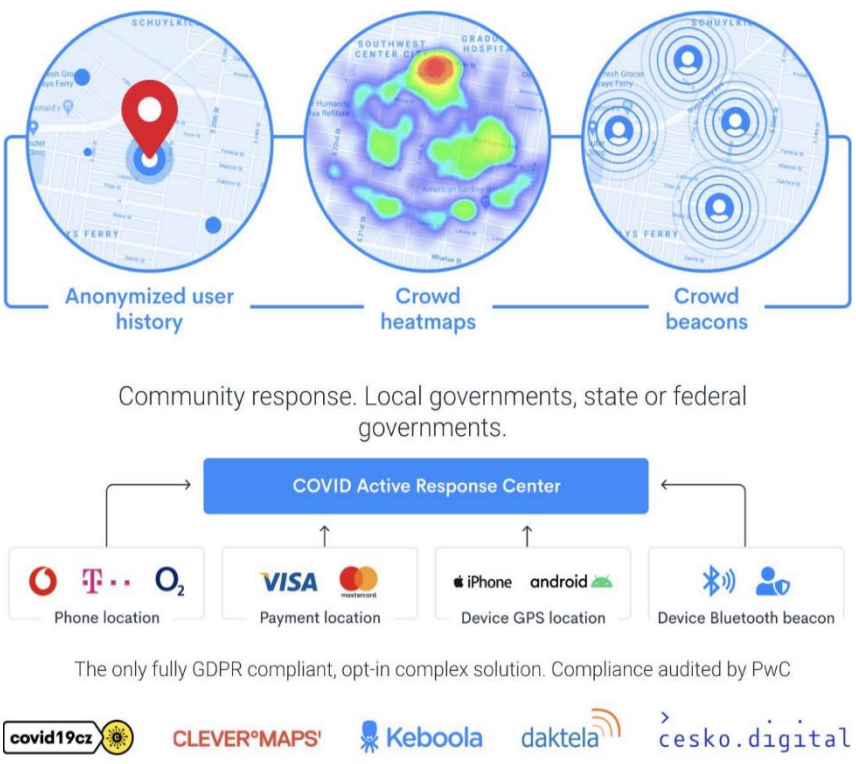
- National Economic Activity Data Command: Dashboard of national economic activity, based on data mainly from banking transactions.
- eRouška: The eRouška application works on the basis of Bluetooth technology. It uses Bluetooth to examine if there are other devices with this application around. If the holder finds out that they are a distributor, the process of evaluating who they met and whether the meeting had a higher probability of transmission follows.
- Maps App Virus Warning: Local map provider Mapy.cz updated their smartphone map application with functionality which sends warning notification to people who have likely been exposed to the disease.
- Remote monitoring of patients at home: Use of digital technology to remotely monitor patients confined to their homes, in order to hospitalize only patients with severe symptoms.
- Mapped: Shortages of Medical Supplies: As many health care institutions face shortages of medical supplies, a newly created map aggregates data about what material is lacking in the Czech Republic.
- Folding@home: This uses computer time and capacity volunteered by users all around the world.

Some other projects worth mentioning are: large-scale COVID helpline established in cooperation with state, Open Source Medical Ventilator (500 open source medical ventilator for COVID-19 patients), as well as Take-Away Restaurant List (all of the restaurants might be serving only customers take-away without entering the

property), Appointment Scheduling for Hospitals (Booking platform for free to all hospitals dealing with the COVID-19 challenge). →

Smart Quarantine

Combining multiple projects and ideas under one umbrella, the companies and individuals from the COVID19CZ initiative have committed to finding a way to ease the economic impact on the Czech Republic and daily life of its citizens. The goal was to find a way to help the state introduce a more targeted mechanism of quarantine instead of the existing one. A proposed solution is called Smart Quarantine, and it includes the developed methodology, technical procedures and the necessary tools, including software and hardware equipment. Smart Quarantine allows, with the infected person's consent, to use data on the movement of his mobile phone for the last five days to create a create a memory map composed of the places where they have been. The map is then used by hygienists during a conversation with the infected person, so that they can better remember where they were, with whom they could have meet, and if it is therefore necessary to contact him or test them.



In addition, the individuals from COVID19CZ help coordinate and mediate the cooperation of volunteers. However, the introduction and management of Smart Quarantine has been solely a matter for the state and state institutions.

Unfortunately, up to the date (September 2020), Smart Quarantine is under development and has not yet been widely implemented by the state due to reasons including the complexity of the project, investment required, and structural changes in the government.[27]

It is important to note that the source code is published only for one part of the project, eRouska app, so this is not a black-box mechanism - the rest of the solution is, and multiple questions and concerns connected to data privacy have already emerged.[28] The currently proposed version is volunteer based and respect for the privacy of the individual. However, it is necessary to warn against careless expansion or interference with the current system.

Hack the Corona

In response to the coronavirus crisis, the Ministry of Industry and Trade of the Czech Republic, together with the CzechInvest agency, organized a virtual hackathon titled, 'Hack the Crisis' with the aim of selecting and supporting exceptional projects that contributed to the fight against the pandemic. Over 200 projects were submitted, and the selected ones have been awarded with the amount of 10 million CZK for implementation and further development of the projects. Among those is an AI-driven"FreMEn contra COVID project", led by Tomáš Krajník from the Artificial Intelligence Center FEE CTU in Prague.

Researchers from the CTU Chronorobotics laboratory are using artificial intelligence to combat the spread of coronavirus. The project is based on the assumption that the virus spreads in the areas with a high concentration of

[27] https://www.irozhlas.cz/zpravy-domov/jarmila-razova-chytra-karantena-druha-faze-spusteni-fungovani-nabor-korona-virus_2005260904_tzr

[28] https://www.profant.eu/2020/chytra-karantena.html

people. The result of the research project is an application called 'Nebojsa' ('do not be afraid' - approx. translation), which is capable of predicting the emergence of crowds and queues in specific locations for up to several days in advance. Thanks to this capability, everyone can find out at what time the highest number of people are in the given place, and plan the necessary route accordingly. The technical solution of the project is based on several years of AI research, which creates spatio-temporal maps from the anonymous user data. Data collection is executed via crowd contributions. In addition, there is no doubt about the sustainability of the project. It will find its application in use even after the end of the crisis, for example during the regular flu season.[29]

Most of the data-driven anti-coronavirus initiatives, prepared by the government in cooperation with technology corporations, allow for movement monitoring at an individual level. "This can lead to the stigmatization of potentially ill people and, as a result of concerns about the reaction of the environment and the behaviour deepening the epidemic. We warn against such erosion of privacy. We propose to embark on a path of prevention and personal responsibility that is sustainable" - says Tomáš Krajník. "Therefore, we decided to offer our system based on the processing of anonymous data by advanced artificial intelligence algorithms that are modelling human behaviour. These have previously been successfully deployed, for example, at the Haus der Barmherzigkeit hospital in Vienna, which specializes in the long-term treatment of elderly patients".[30]

Epidemiologists, doctors, and sociologists from all over the world (Great Britain, Switzerland & South Korea) are involved in the project. Representatives are also discussing possible cooperation with the prestigious American university MIT. →

[29] https://www.fel.cvut.cz/en/aktuality/2020/the-fremen-contra-covid-project-from-the-faculty-of-electrical-engineering-received-a-special-award-at-the-hack-the-crisis-virtual-hackathon

[30] http://cs.fel.cvut.cz/en/page/fremen-contra-covid

Part II

Artificial intelligence in Poland

Chapter I

Policy of the government of the Republic of Poland towards artificial intelligence

After two years of work and consultations, on September 14, 2020, the Committee of the Council of Ministers for Digitization adopted the "Policy for the development of artificial intelligence in Poland[31]". It declares that the government intends to use new technologies and artificial intelligence systems to build the potential of the national economy.

The document sets out actions and goals for Poland in the short-term (until 2023), medium-term (until 2027) and long-term (after 2027) in six key areas:

- AI and Society - a program that is to make Poland one of the biggest beneficiaries of the data-based economy, and Poles - a society aware of the need to constantly improve digital competences

[31] https://bip.kprm.gov.pl/kpr/bip-rady-ministrow/prace-legislacyjne-rm-i/prace-legislacyjne-rady/wykaz-prac-legislacyjny/r1758446092,Projekt-uchwaly-Rady-Ministrow-w-sprawie-ustanowienia-Polityki-dla-rozwoju-Sztuc.html

- AI and innovative companies - a plan to help Polish enterprises developing AI, incl. mechanisms of financing their development and cooperation of start-ups with the government
- AI and science - ways to support the Polish scientific and research community in designing interdisciplinary solutions in the field of AI, including activities aimed at preparing the staff of AI experts
- AI and education - educational activities from primary education to the university level, and for people at risk of losing their jobs due to the development of new technologies
- AI and international cooperation - activities to support Polish business in the field of AI and the development of technology in the international arena
- AI and the public sector - support for the public sector in the implementation of orders for AI, better coordination of activities and development of programs such as GovTech Polska.

The document also provides for the creation, within the governmental structures, of a coordination centre designed to monitor the implementation of AI policy in Poland, as well as to coordinate the activities of partners and today's scattered sources.

"Our mission is to support the society, companies, representatives of science and public administration in taking advantage of the opportunities related to the development of AI, while ensuring the protection of human dignity and conditions for fair competition in global competition" - commented former Minister of Digitization, Marek Zagórski, who, as a result of the reorganization of the Council of Ministers, is now coordinating these issues at the Chancellery of the Prime Minister.

The government policy is generally consistent with core activities of the European Union (EU) and refers to its most important documents and values developed in recent years, as well as to the "Position of the Visegrad Group on Artificial Intelligence"[32].

[32] https://www.gov.pl/web/cyfryzacja/stanowisko-grupy-wyszehradzkiej-dotyczace-sztucznej-inteligencji

The authors of the Polish document, write in the introduction that the data-based economy is a great opportunity "for Polish companies and the Polish economy, because these new solutions and services have been developed and implemented recently". And they rightly note that "it is much easier to build your position in a new, just emerging industry."

They also emphasize that this is an opportunity "for another leap in development and the shift of Poland from the group of middle-income countries, to those with the highest". According to the document, Poland in the field of artificial intelligence has a real chance to become one of the leading countries in the international arena, "with a contribution greater than could result from the size of the Polish GDP or the number of people in relation to the entire economy and population of the world."

The assessment of this potential of Poland is based on the above-average results of Polish students in mathematics and natural sciences in the PISA tests, international successes of Poles in a field related to AI, i.e. in creating modern computer games, the presence of many talented Polish engineers in the world's most advanced academic and business ventures developing AI, and a large number of companies and teams in the country that have already taken action in the field of AI.

Unfortunately, the document does not mention the weaknesses that may prevent the implementation of this ambitious vision. Among several challenges, the most important is related to the level of innovation in the economy. In the Global Innovation Index (GII) 2020[33], the Polish economy has been ranked 38th among 131 surveyed countries (compared to the previous year, it moved up one position).

The GII has been developed annually since 2007 by the United Nations World Intellectual Property Organization (WIPO), Cornell's SC Johnson College of Business and the INSEAD Business School. It measures, among others, expenditure on innovation and outputs such as the number of patent and trademark applications, development of

[33] https://www.wipo.int/global_innovation_index/en/2020/

mobile applications, and exports of advanced technologies. There are 16 European countries in the top 25 and seven of them are in the top 10. The Czech Republic occupies the 24th place, two positions higher than the year before.

In June, the European Commission published the Digital Economy and Society Index 2020 (DESI 2020). Poland was placed 23rd this year - two positions higher than a year ago. The European Commission points out that if the EU wants to be competitive on the international stage, the Member States must digitize even faster than before.

One of the barriers, like in the rest of the world, is also the lack of specialists required to accelerate the development of AI in Poland. The Polish Agency for Enterprise Development in the 7th edition of its report "Monitoring trends in innovation"[34] estimates that only in the next five years will the demand for specialists in this field will reach 200,000 people. →

[34] https://www.parp.gov.pl/component/content/article/58357:do-2025-r-polska-bedzie-potrzebowac-ok-200-tys-specjalistow-zajmujacych-sie-sztuczna-inteligencja?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_parp

Chapter II

The state of advancement of scientific research and education on AI in Poland

It is difficult to estimate the total number of artificial intelligence researchers employed in scientific institutions in Poland, as there is no central database collecting such information. The only collective study on this subject available in Poland is the report "The development of artificial intelligence in the science sector in Poland"[35], published at the beginning of 2020, prepared by the Information Processing Centre - National Research Institute at the request of the Ministry of Science and Higher Education. The information collected there relates to the years 2010-18.

The report shows that in Poland in 2013–18, 1.5 thousand researchers representing IT disciplines published about 5.3 thousand articles or scientific monographs in the field of artificial intelligence. Some of them, i.e. 1.2 thousand researchers, had their articles published in journals recognized as prestigious in this field. They covered machine learning, data mining, image processing, and human-computer interaction. Among the institutions employing the largest number of researchers publishing scientific articles in prestigious journals are: AGH University of Science and Technology (106 people), Warsaw University of Technology, Wrocław University of Technology, University of Warsaw (93 people each), and Poznań University of Technology (82 people).

The report also presents the geographical distribution of 104 AI research centres and 98 universities promoting AI diploma theses. Most of them are in the Mazowieckie voivodship (almost every third research centre), as well as Śląskie and Małopolskie voivodships.

[35] https://radon.nauka.gov.pl/analizy/atlas-SI

In turn, in 2010–2018 students of IT faculties submitted almost 1.9 thousand diploma theses on AI. The largest number of them were prepared in the Dolnośląskie voivodeship. At the Wrocław University of Science and Technology alone, 256 of them were created, i.e. 14% of the total. The next voivodships are Mazowieckie, Małopolskie, Łódzkie, Podkarpackie and Śląskie. Universities from these six provinces are responsible for a total of 68% of theses on artificial intelligence created in Poland.

The same research centre analysed Polish projects in Horizon 2020 - the largest European Union program supporting research and innovation. In 2014-19, EU countries submitted a total of almost 13,000 applications for funding for AI projects. 15% were positively considered of them. 264 applications were received from Poland, 18 of which were accepted, i.e. 7%, for the amount of EUR 23.6 million. With this result, Poland ranks 16th among the EU countries. However, in terms of 100 thousand inhabitants, this coefficient is 0.05 of the project, which gives it only 25th place among the EU countries. The European average in this case is 0.37 of the project.

AI researchers were also asked about the assessment of the system of training new staff necessary for the development of this field in Poland. Almost 60% of them believe that the education market in Poland lacks studies that prepare AI experts. More than half of them perceive insufficient involvement of business in the creation of programs of such fields of study and insufficient infrastructure. A slightly smaller percentage of scientists (53%) believe that a significant barrier to the development of didactics in the field of AI is the drainage of scientists by business and foreign scientific institutions. Almost one third of respondents expect to expand the offer of courses and training aimed at scientists themselves, before they start teaching AI to students.

Against the background of this not very optimistic picture, in the last 2 years there have been many initiatives that may contribute to its improvement. Last year, for example, the Łukasiewicz Research Network was established, which integrates 32 research institutes located in 12 Polish cities and offers entrepreneurs complete and competitive business solutions, including in the field of new technologies for automation, robotics, artificial intelligence and data science. The network employs 8 thousand. researchers and is the third largest such initiative in Europe. →

Chapter III

AI technology financing mechanism in the public and private sector in Poland

The document "Policy for the development of Artificial Intelligence in Poland from 2020" states that because there are few large private companies in our country[36], the financing of AI projects requires the involvement of the public sector and the largest state-owned companies.

The document lists all government programs supporting the implementation and development of innovation as sources of financing for artificial intelligence projects in Poland. Their total value is approximately 7 billion PLN. Theoretically, in each of them, interested entities can apply for financial grants for research and implementation of AI solutions. In practice, there are only a few programs strictly for this, for a total amount of approximately 150 million PLN.

Following the announcement of the government's AI development policy, these programs are to be periodically evaluated in terms of "adaptation to the specifics of the Polish AI market" and its development needs. In dialogue with the market, they will better support investments in human capital and R&D, acquiring appropriate hardware and software, and transferring research results to production environments; creating and sharing data and software under open licenses, as well as free provision of ready-made solutions for the purposes of AI development in Poland.

In addition to domestic funds, Poland intends to seek to include IS financing in the structure of the EU budget for 2021-2027, in particular as part of:

- The Cohesion Fund

[36] According to PARP has less than 3.6 thousand of them; https://www.parp.gov.pl/storage/publications/pdf/2019_07_ROSS.pdf

- The European Regional Development Fund
- The European Social Fund Plus

and programs:

- Digital Europe
- Horizon Europe
- Connecting Europe

Poland also supports the creation of separate, dedicated mechanisms for financial support for AI development in the member states, while at the same time advocating that their resources should be distributed in proportion to the size of the economy of a given country, which will maximize the number of beneficiaries and ensure sustainable development within the EU.

Last year, the Polish Ministry of Digitization announced that in order to fully use the potential of AI, the government plans to allocate approximately 9.5 billion PLN to investments in this sector by 2023[37]. However, this year's and future costs of defending the economy and society from the effects of the pandemic may thwart these plans. The existing financing mechanisms provide only one fifth of this amount, therefore, without the government's intervention, the deficit of funds may prove to be the most serious barrier to the implementation of its ambitious plans in the field of AI.

On the other hand, Polish ambitions can support EU funds. In the budget for 2021-27, 9.2 billion EUR is planned for digital technologies, including the development of AI. The European Commission hopes that the private sector will

[37] https://kometa.edu.pl/artykuly/135,ministerstwo-cyfryzacji-w-ciagu-czterech-lat-przeznaczy-95-mld-zl-na-rozwoj-sztucznej-inteligencji-dzieki-dofinansowaniu-rozwiaz

contribute to this fund. According to the Commission, making the European Union an equal competitor to the USA and China in the field of AI will require 20 billion EUR a year in the coming years.

Our survey shows that public institutions, which have already become involved in the implementation of solutions or are planning them in the near future, are waiting for budget funds and grants from EU aid funds.

Among the companies we surveyed, of those that have already started implementing AI, the vast majority use their own resources. Only one in four of them reported that they have found support in grants from the National Centre for Research and Development and operational programs of the European Union.

When asked about the future financing of solutions based on artificial intelligence, the private sector continues to declare that it will allocate its own funds for this, and approximately one in four companies plans to apply for subsidies from the EU and the state budget.

According to many experts speaking in the public debate about the opportunities for the development of artificial intelligence in Poland, the state should allocate much more money for this purpose than at present. →

Chapter IV

Examples of the use of artificial intelligence in the public sector

Study of forest animals

Institute of the Polish Academy of Sciences

The Białowieża Forest is the last European lowland forest preserved in its natural shape. For almost 60 years, knowledge about animal life in this area has been collected by the Mammal Research Institute of the Polish Academy of Sciences. Recently, scientists have been helped by artificial intelligence.

For years, biologists have been using photo-traps consisting of cameras and motion sensors to study animal behaviour. However, the collected data must be sorted, and then classified.

IBS PAN PhD student, Jakub Bubnicki and his team came up with the idea of developing a special TRAPPER software. It is a database web application supporting the management of projects in which camera traps are used. It facilitates the classification of recordings and photos.

The processing of these data however, still has to be dealt with by humans, and this is a considerable amount of material. For example, during one monitoring session that lasted a month, and in which 70-80 camera traps were used, as many as 40 thousand movies were captured. Therefore, scientists from IBS PAN, in cooperation with PhD students from the Białystok University of Technology and local Python enthusiasts from the PyStok group, decided to enrich the TRAPPER application with artificial intelligence. To this end, they applied to Microsoft for a grant under the AI for Good program. It supports organizations dealing with solving various problems around the world with

grants and technical assistance. In this case, the initiative AI for Cultural Heritage - the protection of cultural heritage - proved helpful.

The team received support in the form of access to the computing power of the Azure cloud. The integration of the TRAPPER application is currently underway, including with the Azure platform and the implementation of broadly understood AI technology, including the animal detection model in photos. It will help you automatically classify and tag photos and videos captured by camera traps. This solution will significantly improve the efficiency of scientists' work.

More: https://news.microsoft.com/pl-pl/features/w-lesie-ze-sztuczna-inteligencja-i-to-wbrew-pozorom-jest-dobra-wiadomosc-tuesdai/

Coronavirus info

Ministry of Health

When the Covid-19 pandemic broke out, an average of 37,000 people reported to the Ministry of Health's hotline. per day. MZ consultants were unable to answer so many questions from citizens. That's when Yosh.AI, a Polish start-up founded by Katarzyna Dorsey, entered the scene.

A team of ten programmers, AI experts, linguists and copywriters from Yosh.AI, working remotely, created an automatic assistant "Coronavirus info" for the Ministry of Digitization and the National Health Fund. Although it usually takes at least several months to develop such a solution, the work was completed in only two weeks. In addition, three teams that did not know each other worked together, so they had to learn cooperation during the project.

As a result, a program based on artificial intelligence was created that answers the most frequently asked questions in voice and text form. Interested citizens can get answers to over one hundred frequently asked questions about:

- Symptoms of infection, prevention measures, post-infection procedures, hospital addresses, telephone numbers, etc.

- Indications of the nearest hospital with an infectious disease ward or facility of the State Sanitary and Epidemiological Station (which the program performs based on the person's location or postal code)
- Up-to-date statistics and other pandemic data.

Now, Yosh.AI's goal is to launch the solution on a larger communication platform, teach the assistant to answer more questions every day, expand the knowledge base, and train the AI to better recognize human questions. It is also possible to adapt the assistant for up to 30 other languages.

Yosh.AI recently participated in the World Health Organization's global hackathon. A team of experts from the health and technology organization selected "Coronavirus info" as one of the 89 winning solutions out of almost 1,700 applications from around the world. →

More: https://yosh.ai/awards.html

Monitoring of excise transports

The Ministry of Finance

Each carrier transporting excise goods in Poland must first report them and connect their vehicle to the national register in the ICT system of the organizational unit of the Ministry of Finance. Artificial intelligence is effective in monitoring these transports.

This intelligent monitoring was introduced to reduce the level of depletion in the most profitable taxes, i.e. VAT and excise taxes.

From October 1, 2018, a road vehicle or driver transporting sensitive goods should be equipped with a tablet or smartphone with an application installed containing a locator or a GPS system used by the carrier. Before starting the transport, these devices must be turned on and their identification numbers should be provided in the

declaration. The system based on SI solutions monitors, among others geographical coordinates of the transport location, its speed or satellite data transmission error.

As you can imagine, this information, multiplied by hundreds of thousands of trucks traversing Polish roads, generates a whole sea of data. This is useful only if it is systematically analysed.

This is done by the analytical system created by the National Institute of Telecommunications - National Research Institute. It combines external location data with the SENT declaration register and then monitors each vehicle carrying the excise goods. The partner of this implementation was Microsoft, which provided the Azure platform and its flexible computing and analytical solutions in the cloud, supported by artificial intelligence.

As a result, the system automatically checks whether the vehicle deviates from the correct route, whether it does not make unplanned longer stops, whether it stops at another monitored truck, and whether it is carrying the declared tonnage of cargo all the time. It reports any irregularities to the supervising services. The introduction of the monitoring system brought enormous financial benefits to the state budget.

Source: own information

Oil refining

Grupa LOTOS

Grupa LOTOS is a fuel concern of strategic importance for domestic security in the energy sector. All key business processes in the company have long been controlled by high-class IT systems. For a year now, cloud solutions supported by artificial intelligence have been working to increase the profitability of crude oil processing.

Lotos is a listed company in which the State Treasury holds more than half of the shares. One of the most modern European refineries is operating in Gdańsk, where the raw material is processed mainly into high-quality fuels. Both in this activity and in all other business processes, the company uses advanced IT solutions.

At the end of 2018, Grupa LOTOS signed a cooperation agreement with Microsoft. The first common goal was to increase the profitability of crude oil processing at the Gdańsk refinery. The company constantly processes many types of raw material. In any case, it starts with atmospheric distillation. As a result, gasoline, kerosene and diesel oil are obtained, and depending on the needs of the refinery, the process is set to maximize one of these products. It is controlled by autopilots that optimize a large number of different parameters. The implementation team decided that it is worth improving their efficiency by harnessing artificial intelligence to help.

First, theoretical models were developed to represent the chemical operation of the processing plant. They promised that you can improve processing efficiency by using the AI platform. After implementation, the new model began to operate in parallel with the autopilot.

It quickly turned out that the solution involving AI is more efficient by 1-2 %. At first glance, not much, but on the scale of the entire group, these are already significant economic benefits. Now the concern is analysing how and when to apply this solution on a larger scale.

More: https://think-tank.pl/wp-content/uploads/2020/06/Raport_THE-ARTIFICIAL-INTELLIGENCE-QUOTIENT_vol-III_ENG.pdf

Fight against smuggling

National Revenue Administration

By using machine learning with the use of neural networks, border controls become more effective. Such solutions are being implemented by the National Revenue Administration (NRA).

The new border control system for goods, connects artificial intelligence solutions with the Internet of Things. X-ray images of bulky goods are analysed by algorithms comparing the detected items with customs declarations. By the end of this year, all Polish border crossings are to be covered by it. This will increase the effectiveness of controls,

streamline the work of officers, and strengthen the protection of the border against illegal smuggling. The implementation of the solution is the result of a competition won by Tensorflight Poland.

This is not the first innovation used by NRA. There are also intelligent robots to fight cybercrime. These are network solutions with machine learning for searching the Internet and the dark web. They build a model according to which websites similar to already modelled websites are sought. They use both keywords and images entered by the user. Importantly, they can be constantly updated. The system supports tasks carried out by the Centre for Combating Economic Crime.

Over one and a half billion websites are registered worldwide. The robot's task is also to search for those that were previously unknown to KAS analysts. Moreover, the solution searches for places not indexed by popular search engines.

As the Ministry of Finance assures, an important advantage of the tool is its modular structure, which will allow for the introduction of new functionalities in the future and will enable further development of the tool. Such devices are indispensable in modern and developing tax administration.

These solutions were created as a result of the MinFinTech project, which is part of the GovTech Polska program.

More:

- https://www.gov.pl/web/finanse/innowacyjne-rozwiazania-it-dla-kas-wybrane-dzieki-minfintech
- https://www.sztucznainteligencja.org.pl/sieci-neuronowe-zwalczaja-przemyt/

→

Chapter V

Examples of the use of artificial intelligence in the private sector

Automation of business processes

YES company

Artificial Intelligence helps YES increase sales, stay in touch with customers and support their loyalty.

YES, is a company that has been producing fashionable jewellery for almost four decades and sells it in 160 of its own stationary stores throughout Poland and via the Internet. According to the KPMG ranking prepared for the "Forbes" monthly, YES is one of the brands that understands their customers the most.

Until recently, the company struggled with fragmented tools to manage online sales and digital channels. It was not easy to aggregate data from multiple systems to prepare clear reports. The company also wanted to increase sales of exclusive collections and raise the average value of the shopping cart. What was needed was standardized solutions for analysing customer shopping paths, managing a loyalty program and personalizing promotional campaigns.

YES, analysed over a dozen solutions available on the market and finally chose the Synerise platform, which provides tools for automating business processes using artificial intelligence.

The implementation took place in the fourth quarter of 2019. A few weeks after starting work, the first effects were visible. By the end of November, the system was launched and ready to handle the highest traffic in the season. As a result, in December this year there was a 60% increase in total sales, and the average value of the basket of products recommended by the system increased by 35%.

The new IT system implemented by Synerise now collects data on the activity of both anonymous and registered users on YES.pl and uses this information to segment them into 125 groups and presents them with personalized product recommendations. It also supports the sending of e-mails and "push" communication and supports the YES Club loyalty program. All these functionalities and the search engine on the company's website are supported by artificial intelligence.

More: https://synerise.com/case-studies/yes

Intelligent robot for kids

SmartLife Robotics

SmartLife Robotics is a company that uses the potential of artificial intelligence in the field of education and entertainment for children. Her Kodi robot will be on the market soon, which will teach and entertain.

The company was founded by experienced ICT specialists from some of the largest international corporations (Samsung, IBM) as well as scientists from the SWPS University and behaviourists. They recently developed the Kodi 1 robot. It's an interactive and intelligent toy for children aged 4-9.

Kodi 1 is designed to make the child experience human-robot interactions in a new, direct way. It offers games that develop their imagination, such as storytelling, association games, and learning about musical and artistic works. Growing up with a smart toy, the child is likely to become more inquisitive and acquire new knowledge with a passion. They will also develop various skills such as perceptiveness, concentration, memory, information processing, decision making and many more. In addition, they can learn the alphabet, writing, spelling, rhymes, basic maths, music, exercise, and foreign languages.

Kodi is a robot toy powered by artificial intelligence. It can hear the baby from a distance and join its play, lead a conversation in a natural voice and even imitate dancing. Its internal memory records the preferences and development of the child. It is also intended to promote responsibility and teach good manners.

Kodi will not be connected to the cloud, and therefore it will not transmit sensitive information to external sources, making it one of the safest robots on the market.

SmartLife Robotics combines its experience in robotics and artificial intelligence with knowledge of cognitive psychology. Ultimately, it wants to produce intelligent robots for three market segments: children, home users and supporting work in the office and commercial spaces. The product for children is to be affordable so that it can be used by a wide range of children. →

More: http://smartlife.global/

Monitoring of agricultural crops

Digital Crops

For several years, Digital Crops has been creating solutions and sensors supported by artificial intelligence that reduce risk factors in the production of plant food.

Digital Crop solutions integrate information from the Internet of Things devices, drones, weather stations, soil samplers, as well as digital photos and machines. By using big data analytics, they help agricultural producers run economic simulations, optimize production and maximize profits.

The company uses a unique artificial intelligence model, which predicts the possibility of biological threats such as weeds and pests as well as pathogens. Its projects, already recognizable on the market, include:

- AI-assisted MetPro weather station that can operate at any point of cultivation for approximately 5 years on one battery, away from economic infrastructure
- Three-level, wireless, self-sufficient sensor of soil moisture and temperature
- An automatic soil sampler that collects, marks and transports samples for detailed analysis

These and other AI-based solutions are used by the Potato Federation, an association of agricultural producers working to improve the quality and efficiency of Polish potato production. The organization is working on a biological hazard prediction system for potato cultivation. It is to predict the occurrence of weeds, fungi and parasites during the incubation period or at the initial stage of plant development. Thanks to this, plant protection products will be used pointwise, in the minimum recommended dose, not necessarily on the entire cultivated area.

The platform is to collect data from many sources, and the algorithms implemented in the system will determine the possibility of a threat in a specific area and its type. Additionally, based on the analysis result, the system will advise which chemical agent should be administered and suggest other, non-invasive to the environment methods of dealing with the risk.

More:

- https://www.digitalcrops.pl/
- https://federacjaziemniaka.pl/co-ai-moze-zrobic-dla-polskiego-ziemniaka/

Forecasting drug production

Adamed Group

Thanks to artificial intelligence, Adamed has automated the preparation of drug demand forecasts, saving time and increasing the accuracy of this process.

The Adamed Group is one of the largest manufacturers of pharmaceuticals in Europe. The Polish company has a presence in over 65 countries, offering over five hundred of its products. The company's priority is to be able to effectively forecast demand. This requires not only collecting multiple inputs, but also treating each brand independently and taking into account various external factors. For example, seasonality is critical to the need for anti-flu medications, but less so for joint pain medications.

So far, subject matter experts have created 18-month sales forecasts for the company's various product lines. However, it was a laborious and lengthy process. To modernize it, Adamed used the support of Predica. It is an international company providing IT consulting services. Predica specializes in the Azure cloud, incl. in the fields of data analysis, machine learning and application development.

The company designed and developed a data analysis platform for Adamed, based on Azure Data Services and Power BI. The solution allows you to generate automatic forecasts as well as optimize the supply chain and marketing decisions.

To build a solution, huge amounts of different data had to be first collected. For this purpose, the Azure Data Factory service was used. The processed and unified data was then consolidated into Azure SQL. In the next step, Predica used this dataset to create a forecasting model using Azure Machine Learning. The results of the analysis are presented in reports generated in the Power BI service.

In this way, Adamed fully automated its process of generating demand forecasts. Monthly updates show the projected results with an accuracy of 5%.

More: https://www.predicagroup.com/clients/adamed/

AI makes life easier for lawyers

Association of Notaries

In Poland, changes to the law take place relatively often - says the global consulting company Grant Thornton. Therefore, lawyers must constantly study volumes of files, thousands of judgments and interpretations. To help them in this, two young Poles have created a solution using artificial intelligence.

Maciej Troć, PhD student in law at the University of Warsaw, and Dr. Adam Zadrożny, astrophysicist, assistant professor at the National Centre for Nuclear Research, decided to help the legal community. They have created a tool

that is able to answer any legal questions and automatically search for relevant decisions or interpretations. It was created using computing resources, among others Google Cloud for Startups, offered by the company IUS.AI.

How is it working? After entering any legal question or a fragment of the facts into the search engine, it indicates fragments of judgments that are related to this question or directly answers them. The application algorithms work in two layers - at the level of creating a semantic network from legal information contained in jurisprudence and other sources, and at the level of sorting the results - users mark which fragment is the most helpful and the system learns from it. It doesn't matter if your documents have similar keywords or not. The model will find all semantically similar fragments and combine them with the relevant jurisprudence or legal literature.

Four large law firms and Ultima Ratio - the first electronic arbitration court in Poland operating at the Association of Notaries of the Republic of Poland currently use the software as a pilot. Thanks to the implementation of IT modules based on artificial intelligence, court judgments can be issued faster. New functions are able to replace a human in up to 80 %. trial and award process, helping the arbitrator to focus on the merits of the case. →

More: https://przemyslprzyszlosci.gov.pl/elektroniczny-sad-arbitrazowy-dla-przedsiebiorcow-dostanie-wsparcie-ai/

Chapter VI

The impact of artificial intelligence on the labour market in Poland

Experts dealing with the impact of artificial intelligence on the labour markets do not agree. Some predict that 80 % of people will lose their jobs. Others believe that AI, like any previous revolutionary technology, will free people from simple, repetitive activities, but create completely new, non-existent jobs.

Last year's report by the IBM Institute for Business Value[38] on the creation of qualified teams in organizations suggests that due to AI in the global economy, there will be both far-reaching reductions in employment and a sharp increase in demand for skilled workers. In the first case, it is expected to affect 60 million people in the 12 largest economies in the world in the next 2-3 years. They will lose their jobs unless they retrain quickly. Another 120 million will have to significantly increase their competences, but still by 2030 these economies will lack 85 million qualified employees. Thus, the conclusion is that automation and AI will only deprive people of work without the qualifications needed today and in the near future.

Similar conclusions are led by the Microsoft report on the "AI & Skills" research conducted this year among 12 thousand employees and leaders in larger enterprises in 20 markets around the world, including 611 representatives of Polish companies employing more than 250 people. According to the authors of the report, artificial intelligence will trigger such business changes that are to generate up to 120 million jobs in these countries in the next three years.

Based on the above and many other studies, it can be concluded that AI will change the Polish labour market in stages.

[38] https://www.ibm.com/downloads/cas/EPYMNBJA

In the next 5 years, the demand for employees capable of interacting with AI systems will grow rapidly. People who cannot improve their qualifications will face a serious challenge. Some of them will take up low-complexity jobs of people retiring, some will have to take up jobs that, due to low productivity, will not be automated in this period. Only a few people who want to work, will not find any employment.

In the next 5-10 years there will be widespread automation of work. It will cover all routine activities and a large part of the work considered creative today, such as journalism, marketing, legal advice, graphic services, and managing small projects. Instead, new professions will emerge, but it is difficult to conclusively conclude today that their number will compensate for all jobs replaced by robots and AI and subsequent retirement. Mass unemployment may emerge. Trying to forecast the situation on the labour market in 15 years and beyond, seems to be fruitless today.

The survey conducted by us in private sector companies and public institutions, clearly shows that we are in the first stage. Wherever AI-based solutions have been implemented or are planned to be implemented, there are no plans to lay off employees so far. The public sector points to three approximately equivalent responses by its institutions:

- AI adaptation will free employees from routine activities and allow them to be redirected to new, previously not undertaken tasks
- Workers will not be laid off, but will need to acquire new competencies to take full advantage of AI solutions
- Employment will increase because employees with new competences will be needed to operate AI systems.

On the other hand, among the private companies that answered our questions, half see no reason for layoffs in connection with the introduction of AI solutions. As a representative of one of them said, they will "keep employment at a similar level and develop our current workforce towards more creative tasks".

The other half even plan to increase employment, arguing, for example, that "the savings from automating the company can be used to increase the employment of specialists in other fields" or that they predict "an increase in employment as additional types of products are developed.

Chapter VII

Artificial intelligence systems in the fight against Covid-19

Artificial intelligence automates and improves many medical procedures, detects early symptoms of infection, and conducts interviews with potential patients. Machine learning algorithms also help in the process of developing potential vaccines and drugs for the coronavirus.

At the beginning of July 2020, the intelligent DECODE system[39] was presented. It was developed by a team of researchers from the Silesian University of Technology and Specialist Hospital No.1 in Bytom. Based on machine learning techniques, it helps in the initial exclusion of Covid-19 among people with symptoms also typical of other diseases. Thus, it will enable the quick identification of patients who are actually infected with the coronavirus.

Another solution for the employees of this university - CORNELIA - helps to fight the pandemic. The tool also supports healthcare professionals in diagnosing the coronavirus. Earlier, scientists from the Silesian University of Technology developed the CIRCA online system, which speeds up Covid-19 imaging diagnostics in hospital emergency departments. It is now available for free as a web application[40].

The Polish start-up BrainScan.ai has been working on automated analysis of images from computer tomographs for several years[41]. BrainScan's certified system, which uses machine learning methods, helps radiologists interpret brain imaging studies with an efficiency exceeding 95%. Now, a company supported by a grant from the Medical

[39] http://szpital1.bytom.pl/system-decode-z-politechniki-slaskiej-wspomaga-diagnostyke-covid-19/
[40] https://covid.aei.polsl.pl/
[41] https://brainscan.ai/

Research Agency is working on an algorithm capable of recognizing small changes in the chest in the CT image that indicate infection with the Covid-19 virus[42]. In the first phase, the system will soon be launched in 8 Polish hospitals.

From February to May 2020, the number of scientific papers published on COVID-19 increased from 29,000. to over 138,000, and by the end of the year there are to be over a million. How to find what is most important or needed in this thicket? The World Health Organization faced this challenge, which is why it commissioned an analysis of over 170 scientific studies from around the world on the effectiveness of social distancing and face masks in fighting the pandemic. Effect? Research shows that only when using these two agents, the risk of infection decreases by more than 80%. The review, cited around the world, was created thanks to, Evidence Prime, a Polish-Canadian company dealing with artificial intelligence, based in Krakow. The company, associated with the Canadian McMaster University, created the LaSeR system - Living Systematic Reviews, which was used to quickly verify the scientific works used in the analysis[43].

There is a lot of false information spread around the Internet around SARS-COV-2 / COVID-19, which hampers rational social behaviour. They are helped by the #FakeHunter[44] system, which uses artificial intelligence to verify them. It has been operating since spring 2020 and is run by the Polish Press Agency together with GovTech Polska. With its help, anyone interested can quickly verify the accuracy of information regarding the coronavirus and the pandemic. Chatbot works, among others based on the NLP natural language processing mechanism and solutions in the field of cloud services, provided by Google Cloud and Amazon AWS.

Business and scientists in Poland have also joined research on a vaccine against coronavirus. The Polish bioinformatics company Ardigen[45] has started cooperation with COVID-19 Vaccine Corporation from New Zealand. The

[42] https://abm.gov.pl/pl/aktualnosci/332,Diagnostyka-obrazowa-i-badania-lekowe-w-walce-z-COVID-19-z-rekomendacja-ABM.html
[43] https://evidenceprime.com/laser/
[44] https://fakehunter.pap.pl/
[45] https://ardigen.com/news/we-are-ready-to-support-your-efforts-in-the-fight-against-covid-19/

company uses cutting-edge bioinformatics and artificial intelligence to identify the optimal set of neoantigens as vaccine targets. The basis of the solution is a proprietary algorithm capable of predicting the likelihood of an immune response eliciting. The Polish supercomputer Prometheus at the AGH University of Science and Technology in Kraków has the computing power of 2.65 petaflops and is currently the fastest in Poland. Coronavirus research has been given priority in accessing its resources since the beginning of the pandemic. Teams of scientists with the help of Prometheus, study the antibodies present in the body during the infection, the molecules that inhibit the infection and the possibilities of vaccine development.

The computing power of the super machine is used, among others, by the newly established Centre for Individualized Computational Medicine - International Research Foundation "Sano"[46] with its seat in Krakow. The centre cooperates with many national and international centres. The current project aims to help clinicians fight the virus by using artificial intelligence methods to predict disease progression in people who have been infected. AI algorithms are trained on data currently from two groups of infected people - the first one is patients from Poland and the other one from Brazil. The aim is to develop a model that will help to automatically predict disease development based on preliminary measurements in patients who have just been admitted to the hospital. It is also intended to assist doctors in making decisions about a potential treatment regimen.

Another project is being carried out by the Institute of Genetics and Biotechnology of the University of Warsaw. Prometheus' computing infrastructure has already allowed the modelling of a large fragment of SARS-CoV-2 genetic material, causing its development and multiplication in the host cells. The effect is to find the viral RNA fragment to which potential drug molecules can attach. Some of Prometheus' computing power has also been made available for a pan-European "pandemic" hackathon. Thanks to it, new solutions were created in the fight against the coronavirus. The Hackathon proved to be a success and significantly contributed to the fight against the pandemic[47]. →

[46] https://sano.science/contact/
[47] https://www.euvsvirus.org/finalreport.pdf

Part III

Recommendations on AI development in the public and private sector in Poland and the Czech Republic

Chapter I

Assessment of the readiness and the level of advancement of the public sector in Poland and in the Czech Republic to use AI technology in the reform of the decision-making process by the state administration

Public sector in the Czech Republic

Public administration in the Czech Republic is at the start

Despite ambitious plans formulated in the "National Strategy of Artificial Intelligence in the Czech Republic", announced in 2019, the current readiness of the Czech public administration to implement and use specific artificial intelligence applications are rather low. On the one hand, the crisis caused by the Covid-19 pandemic has launched

many useful AI-based projects focused on combating the virus, and on the other hand it is draining public financial and human resources that were originally intended to modernize public administration and the entire public sector.

Therefore, the implementation of the Czech national strategy for AI requires, in the short term, the development of pilot projects to improve public administration and, in the long term, their implementation for the benefit of citizens. There are already first solutions of this kind, for example, chatbots informing about GDPR issues on the website of the Confederation of Industry and Transport of the Czech Republic or about anti-virus activities on the website of the Ministry of Labour and Social Affairs. Another example is the document anonymization tool available on the government's Public Affairs Portal, which also uses AI elements. Another promising project is the use of AI tools to transcribe recordings of court proceedings.

New projects in public administration are usually financed through public procurement or through public support mechanisms for research, development, and innovation (inter alia through the Technology Agency of the Czech Republic or individual ministries). Public administration bodies and other public institutions dealing with research projects play the role of the so-called application guarantors, who on the one hand constitute a real environment and database for the development of AI applications, and on the other hand test and verify the developed solutions in practice.

The Office of the Government also supports expert initiatives, such as the AI Observatory and Forum[48], which is an expert platform for monitoring legal and ethical rules for Artificial Intelligence. It also aims to introduce the online course Elements of AI[49] to the public.

The health service shows the greatest readiness to use AI technology in the Czech public sector, as evidenced by selected implementations presented in more detail in this study. The Ministry of Health identified several key areas

[48] http://observatory.ilaw.cas.cz/

[49] https://www.elementsofai.com/

in which the use of AI requires, however direct or indirect, support, additional legal regulations or legal interpretation, and promotion. One of the key areas is the support of decision making, where AI-based predictive tools would significantly improve the use of large statistical databases collected in the healthcare sector.

In line with the goals of the "Health 2030" strategy and the "Digital Czech Republic" strategy, the Ministry of Health plans to directly involve AI technology in many health care programs in the coming years.

AI technologies are also used by the Police of the Czech Republic to improve public safety. The main area of their interest is the analysis and evaluation of large databases, using in particular methods such as text analysis, object recognition, voice and image. The use of AI tools in police practice also includes data decryption, cryptocurrency tracking, de-anonymization of communication in the TOR network, etc. In addition to financing these projects from national funds, the Czech Police also participates in projects financed from the EU, Swiss and Scandinavian funds.

Development is hampered by lack of funds and persistent routine

The wider use of AI-based applications in the public sector in the Czech Republic is hampered by the following main barriers:

- Lack of funds for major upgrades and innovations of older systems, within which it would be possible to implement AI technology
- Lack of motivation and stubborn routine of "paper document flow" in public administration
- The necessity to announce tenders that last a very long time and in which there is pressure on using the lowest price as a decisive factor in selecting an offer
- Concerns about breach of cybersecurity rules during implementations

- High level of project complexity, for example implementations in healthcare require a complex process of data ordering and quality control, and then verification of the correctness of procedures and algorithms and their certification
- Unresolved ethical, accountability and legal framework issues.

Public sector in Poland

Public institutions are preparing to implement AI and are aware of the benefits of using it

The Polish government wants to use artificial intelligence technologies to accelerate the country's development. The recently published "Policy for the development of artificial intelligence" is to help achieve this goal. The document specifies the requirements and conditions for the application of AI, which cover all phases, from designing solutions, through research, development, implementation, application and use, to exclusion from the market. The creation of a coordination centre which will coordinate activities in this area and monitor them is also planned.

Our survey of central and local government authorities shows that they are aware of the benefits that AI-based solutions could bring to their work. However, three quarters of them are just analysing their needs and possibilities in this area, and only one in six institutions implements, tests or already uses AI applications.

These conclusions are similar to the results of the much wider IDC and SAS study[50], according to which in Central and Eastern Europe only 3% of public sector institutions use artificial intelligence algorithms, and only 8% plans to implement them. On the other hand, in the countries of Western Europe, these rates are respectively 30% (already used) and 20% (planning).

[50] https://branden.biz/wp-content/uploads/2020/09/how-ai-change-the-public-sector.pdf

Among the expected effects of AI implementations, the institutions surveyed by us most often mention:

- Elimination of repetitive activities
- Detecting and combating fraud
- Solutions to many social problems in areas such as health, agriculture, security, and manufacturing
- Better healthcare, less perishable household appliances, safer and cleaner transport systems, better public services
- Reducing the costs of providing services (transport, education, energy and waste management), improving the sustainability of products
- Equipping law enforcement bodies with adequate tools to ensure the safety of citizens
- Improved patient health as a result of the use of predictive models that allow for earlier detection of health risks
- Increase in the efficiency and quality of public services provided, cost optimization and improvement of decision-making processes.

Against the background of the overall picture, the GovTech Polska project is an ambitious undertaking of the Polish central administration. It is an inter-ministerial team that organized the first hackathon for public administration three years ago. At that time, a solution for tracking fraud on auction portals was created. Today, GovTech already plays a strategic role in the development of AI in this sector: it initiates further implementations in central institutions and tries to build bridges between the public and private sectors.

GovTech also supports implementations in the Ministry of Finance, which, in our opinion, uses AI technology most widely among the central administration institutions in Poland.

The main barriers are the lack of money and specialists

The institutions we surveyed accurately assess the causes that hinder the implementation of AI in the public sector. They are similar to those indicated by experts and other studies. The two biggest obstacles are lack of funds and competent specialists. In addition, the following challenges are mentioned:

- Complex law, often contradictory regulations or unordered procedures
- Lack of a coherent data structure or too little data, as well as low social trust, hindering the collection and processing of data
- Lack of facilities and hardware infrastructure, which makes it impossible to develop and test AI, including lack of test algorithm libraries
- Lack of AI provisions that would be risk-adjusted but not restrict innovation
- Lack of citizens' trust in new technologies and knowledge of the broadly understood AI, as well as the benefits of implementing projects
- The scarcity of proven case studies and good practices that can be used

Comparison of the public sector in Poland and the Czech Republic

The governments of the Czech Republic and Poland share similar ambitions to use AI to accelerate the economic and technological development of our countries. However, Covid-19 has now relegated these targets to the side-lines. It is true that both in the Czech Republic and in Poland we have found many examples of the use of AI in the fight against the current pandemic, however, it is not of such a scale of applications that would significantly change the overall, rather pessimistic picture.

The summaries presented above, show that the level of advancement of the public sector in the application of solutions based on artificial intelligence in Poland and the Czech Republic are similar. Institutions in both

countries are at the stage of analysing their needs and possibilities. Fortunately, they are aware that the AI era is approaching and that major changes need to be made in the public service as well, so that social needs are served faster and more effectively. Therefore, the public sector is looking for knowledge, already proven examples of implementations, and wonders about the legal and ethical implications of AI development. This is a good climate to start implementations. Now an impulse for concrete action is needed. In our opinion, this impulse should be provided by the governments of both countries.

The pandemic should not be an excuse for failures in this field, because the level of AI development in our countries, as in the entire region of Central and Eastern Europe, significantly differs from the advancement of Western Europe. We have 10 times fewer public institutions that already use AI applications. But those that have chosen to do so report increased efficiency, faster procedures, and often lower costs. Which means it was worth doing it.

In our countries, there are also similar barriers to the development of AI in the public sector. This is mainly the lack of financial resources and the lack of specialists who could deal with the preparation of projects and their implementation. In some groups of institutions, we also noticed a typical reluctance to any changes, and an attachment to old routine ways of working.

Therefore, even before the pandemic comes to an end, and in the anticipation for funds from the new budget of the European Union, our governments should at least make an organizational and intellectual effort. In our opinion, it would be worthwhile to elaborate plans now, train staff, mobilize research centres, prepare specific projects, popularize already implemented implementations and prepare the public opinion for all these changes. →

Chapter II

Assessment of the readiness and the level of advancement of the private sector in Poland and the Czech Republic to adapt solutions based on artificial intelligence

Private sector in the Czech Republic

Insufficient impulse for innovation from within

According to the analysis of the development potential of artificial intelligence in the Czech Republic prepared for the Office of the Government of the Czech Republic, the starting conditions for the implementation of AI technology in the Czech Republic are not optimal[51]. Most domestic companies are at the lower end of global value chains or are controlled from abroad. In their case, decisions to introduce innovations are made outside of them. In the Czech Republic, we do not feel such strong pressure to innovate as in other countries.

There are numerous large international companies from various industries in the Czech Republic that are interested in using innovative technologies. Many local companies provide AI development services, and many global software companies already provide AI-based solutions in their software packages (e.g. IBM, Oracle, Microsoft). All this means that artificial intelligence is more present in the private sector than in the public.

[51] https://www.vlada.cz/assets/evropske-zalezitosti/aktualne/AI-souhrnna-zprava-2018.pdf

However, across many industries, larger companies are also more averse to the risk associated with implementing innovations. They often postpone commitment to breakthrough technologies until they have proven their sufficient market potential. For domestic research institutions, and especially for companies providing AI solutions, this means the need to focus on foreign partners who are more open to such solutions.

In the Czech Republic, the level of practical use of AI in companies is below average compared to other countries. Czech business leaders seem to be more sceptical about the potential benefits of AI than their counterparts in neighbouring territories. Only 51% of representatives of Czech companies are convinced of the positive impact of AI on business - according to the Microsoft study "Business in the Age of Artificial Intelligence". In the Czech Republic, a total of 100 leaders of large companies participated in the survey[52].

The positive news is that 70% of domestic companies are in the process of preparing and experimenting with the use of AI. However, only 17% of companies in the Czech Republic have entered the implementation phase. Domestic companies do not lack enthusiasm for AI, but they lack a clear strategy and specific business scenarios on how to use artificial intelligence in practice.

Moreover, many Czech company leaders report that they are experimenting with AI or using it to optimize their existing business processes - but not to introduce any fundamental innovations. "We see AI being used to optimize the existing business processes, where added value can never be as high as when creating new processes through disruptive innovation." - says Dalibor Kačmář, National Technology Officer at Microsoft.

A 2019 study by EY and the Chamber of Commerce of the Czech Republic revealed that the departments that use the most AI so far include the supply chain, research and development or sales. Contrary to this, areas that have so

[52] https://news.microsoft.com/europe/features/leaders-look-to-embrace-ai-and-high-growth-companies-are-seeing-the-benefits/

far made less use of the potential of artificial intelligence in the Czech environment are marketing, finance, and human resources[53].

According to the study, Czech companies consider the increase in productivity (49%) and also the reduction in costs (30%) to be the greatest benefits of artificial intelligence. However, one of the biggest obstacles for respondents is the lack of qualified staff (33%). The survey showed that after the implementation of AI, respondents use internal human resources the most, or retrain their employees. "However, such a procedure is not very effective, the related investment costs may not always pay off, for example, just due to the departure of qualified personnel to the competition," points out Karina Kubelková, chief analyst of the Czech Chamber of Commerce.

SMEs and start-ups drive AI-powered innovation

Czech Republic has a very active start-up stage and a number of small and medium companies focusing on custom AI development. Some examples are Blindspot, GoodAI Solutions, Recombee. According to a number of business leaders, one of the most common ways to introduce AI innovation in their companies is to cooperate with such a company on a project base or buy a solution from it, rather than build an in-house team. This is logical since AI is still a very specific and narrow expertise domain.

The most common model of cooperation of AI developers and private companies is based on the Proof of Concept (POC), which is a way to demonstrate that AI technology is financially viable. The start-up essentially creates a prototype in a sandbox-environment to prove their technology is capable of handling real-world applications. The overall objective of a POC is to find solutions or improvements to a customer's existing technologies and products. However, it does not always clearly reflect the speed and possible results of the project as a whole, which is becoming more complicated incrementally. "One of the possible barriers to wider AI implementation in the private sector is a

[53] https://aiworld.cz/umela-inteligence/ey-vetsina-ceskych-firem-planuje-investovat-do-umele-inteligence-jeste-do-konce-roku-486

too long experimenting phase, many times without clear business goals. Consequently, some companies try to build 'greenfield' AI solutions, while there are many existing 'building blocks' for AI development, provided by leading IT companies like Microsoft, which can significantly speed up the development, testing and deployment. Using them is often eventually more cost-efficient and can minimize the risk of failure" - pinpoints Dalibor Kačmář, National Technology Officer at Microsoft.

Guillermo Alda, managing partner of GoodAI Solutions, explains how his team ensures the smooth transition between the proof of concept and the implementation: "What we do is always check two boxes when starting the POC. The first is from a business point of view, always agree on what happens next if the POC has successful results. There has to be an automatic continuation of the project to keep the teams mobilized and not to lose the momentum. The second is always to involve an IT architect, who will make sure the solution will be compliant with the IT policies which will allow the POC to be used and add real value. It takes a bit more time to kick off the cooperation, but it pays off for both sides in the long term" - explains Alda.

Availability and a clear understanding of the technological potential of AI are important for its wider deployment, not only for larger companies, but also for smaller enterprises. There are approximately 1.4 million small and medium-sized enterprises in the Czech Republic. Together, they make up 38% of the Czech GDP and employ around 2.4 million people in the Czech Republic alone. According to a survey by Facebook and the Association of Small and Medium-Sized Enterprises and Self-Employed Persons (AMSP CR), the digitalization for this group is of key importance, but the digital skills are often not sufficient and as good as entrepreneurs themselves would like them to be[54]. That leaves a lot of space for employing the power of new technology, yet also shows the need for more fundamental preparation of businesses in regards to digital skills, before the AI-powered advancements are to be implemented and used to the maximum capacity.

[54] https://www.businessinfo.cz/clanky/facebook-vzdelaval-male-a-stredni-podniky-v-regionech/

Private sector in Poland

It's not easy to know how many companies are using AI, but the number is growing rapidly

It is not easy to assess the real degree of saturation of the Polish private economy with AI applications. Different research carried out at the same time yields different results, depending on the methods used, the selection of research samples, and the way of formulating the questions. Probably many companies declare the use of AI, for example, Google Analytics that uses machine learning and is widely available to Google users, or applications in mobile phones. The real business potential of AI, however, lies in its ability to transform company-owned data into knowledge and apply it to optimize employee decisions and automate business processes, thereby reducing costs and offering innovative products and services.

Our survey, which did not aspire to be representative, but was conducted among companies clearly interested in AI, shows that every third of them are already at the stage of applying AI applications in practice, every twelfth is currently testing it, and every sixth is implementing it. These are mostly large and medium-sized entities with a nationwide range. As many as half of them use their own research and development when implementing AI solutions, every fifth buys proven solutions from others and only every eighth works with start-ups.

The latter are developing very quickly and, due to the lack of domestic orders, they are looking for clients abroad. Three years ago, the www.mamstartup.pl portal already estimated that 1,200 start-ups worked on AI-based solutions. In our opinion, their number has increased significantly since then.

Business artificial intelligence is most often present today in the financial, insurance, ICT and trade industries. This is due to the fact that there is a lot of data there, and their advanced analyses bring benefits that translate into specific financial results. The automotive and energy sectors are also interested in rapid AI implementations.

According to the Microsoft report "AI & Skills"[55] from research conducted in March 2020 in Poland and in 19 other countries, more advanced AI solutions are used by 23% of large companies, 44% are introducing them, and the others do not think about it yet. But four fifths of those that have already implemented AI, claim that it brings very tangible business benefits.

The most optimistic results are achieved by the extensive Ipsos study[56] conducted at the beginning of 2020, commissioned by the European Commission. It found that, on average, as many as 42% of the companies in the European Union member states as well as in Great Britain, Iceland, and Norway already use at least one artificial intelligence technology on a daily basis, and 25% uses at least two. 18% of European companies have plans to use AI in the next two years, and 40% have not taken any action in this regard and are not planning to take any action. The largest number of implementations was recorded in ICT, educational, industrial and healthcare companies.

Compared to the European average, companies in Poland are lagging behind. On average, 34% of them declare that they use at least one AI technology, whereas 18% uses at least two. Every fifth company in Poland intends to implement AI solutions within 2 years, and 44% does not plan such implementations in this period.

The breakdown of this data by company size is interesting. 56% of large companies, 37% of medium, 18% of small and as much as 38% of micro companies (5-9 employees) in Poland reports that they already use AI solutions (EU-27 respectively: 55, 49, 39, 38%).

Business has doubts about the profitability of AI solutions

It must be clearly emphasized that the added value of AI-based solutions is not completely obvious to many managers in Poland. “Technology Quarterly”, a supplement to “The Economist”, sustains such doubts. In the June 2020

[55] https://news.microsoft.com/pl-pl/2020/06/30/badanie-microsoft-ai-motywuje-firmy-do-podnoszenia-umiejetnosci-pracownikow/
[56] https://ec.europa.eu/digital-single-market/en/news/european-enterprise-survey-use-technologies-based-artificial-intelligence

issue, its authors wrote that AI technologies in business generate too little in the way of benefits for the time being, so their development should not be expected. In turn, other data shows that the pandemic significantly slowed down this year's AI implementations in many companies around the world. A year ago, every fifth, and now only every twenty-fifth enterprise introduced them.

Despite this scepticism, the number of ready-to-use AI-based business applications is growing rapidly. There are many more of them than companies can implement. Entrepreneurs, like most people in the world, need time to mentally adjust to the technological leap that is taking place today. Eventually, however, "companies will adopt AI not only because they can but because they must," said Ritu Jyoti, vice president of the AI program at IDC. In his opinion, artificial intelligence will help companies operate more flexibly, innovate faster and, as a result, grow faster than their competitors.

The main barrier in companies is the lack of AI specialists

In our survey, we asked companies what prevents them from using AI technology the most. The most frequently mentioned factor was the lack of competent specialists who could lead the implementations. This conclusion coincides with many other analyses concerning barriers to the digitization of the Polish economy.

In October 2020, the well-versed Digital Poland Foundation published a report prepared in cooperation with Accenture and Microsoft, entitled "Artificial Intelligence in Poland - competences of AI experts"[57]. It states that Poland ranks 24th in terms of saturation with AI practices in the European Union. The criterion was the participation of AI specialists among the total number of employees. With this result, Poland was placed in the middle of the ranking of Central and Eastern European countries. Estonia is the leader of the region, to

[57] https://www.digitalpoland.org/assets/publications/sztuczna-inteligencja-w-polsce-kompetencje-ekspertow-ai/sztuczna-inteligencja-w-polsce-kompetencje-ekspertow-ai.pdf

which Poland loses as much as 70%. This debunks a fairly common myth of a large number of AI developers and experts in Poland.

Moreover, in Poland there is a mismatch between the available AI experts and the market needs. First of all, there is a shortage of specialists in computer vision. The most sought-after and scarce are experts who know libraries or programming environments such as PyTorch, OpenCv, Scikit-learn, Caffee and NLTK.

The largest number of AI experts in Poland are employed by global companies such as Intel, UBS, TomTom, Aptiv, Dynatrace, Google, Microsoft, IBM and Samsung. They have located their research and development centres in Poland.

According to the authors of the report, the deficit of AI specialists clearly shows that the Polish economy still has a lot to do in this field. This conclusion is also confirmed by the report of the Polish Agency for Industry Development. This government agency estimates that by 2025 Poland will need 200,000 specialists in artificial intelligence. In our opinion, the preparation of so many specialists will be extremely difficult. This calls into question the real ambition of the government for artificial intelligence to accelerate the development of the Polish economy.

Comparison of the private sector in Poland and the Czech Republic

As in the public sector, the degree of readiness of the private sector in the Czech Republic and Poland to implement applications based on artificial intelligence are similar. Both in the Czech Republic and in Poland, branches of international concerns are leaders in this respect. They have a strong financial and technological background, which allows them to use the potential of artificial intelligence in the first place. However, there is nothing disturbing about this. It is these companies that brought modern management methods and advanced technologies to the economies of our countries that were transforming after 1990. Now they will also become a positive benchmark for their business environment. They will mobilize their suppliers and smaller

competitors to follow a similar path and thus contribute to increasing the level of innovation in the Czech and Polish economy.

Other enterprises in our countries are paying close attention to the upcoming revolution, but also with anxiety. Our analyses confirm that most of them are at the stage of pre-implementation analysis and looking for evidence that the related effort will bring about the promised results. About one third of these companies will implement or have already implemented AI applications. On the other hand, all of them are worried about the lack of appropriate specialists and this problem connects companies in both countries the most.

However, the Covid-19 pandemic slowed down the implementation of AI in the economies of the Czech Republic and Poland. Therefore, in our opinion, entities from the SME sector in our countries right now need additional incentives and support from specialized government agencies. Our governments should not wait for the pandemic to end, but rather speed up programs to support the digital transformation of their local businesses. The key is especially:

- Directing public research and academic centres to developing AI applications for the SME sector
- Activating the public sector to order AI-based solutions in private companies, which may improve the performance of public tasks
- Educating SME owners and employees on the practical benefits of using AI in their companies
- Preparing practical guides on how SMEs can use AI applications under current and future regulations
- Improving digital literacy for society as a whole and spreading understanding for AI
- Supporting the free flow of information and the sharing of best practice among all actors involved in AI development.

Companies that already use artificial intelligence systems in their business processes point to the many benefits of this. They have more efficient business processes, make decisions faster, target customers better, avoid scams, and all this brings them better financial results. It is in the interest of the governments of the Czech Republic and Poland that this knowledge reaches all enterprises in our countries as soon as possible. →

Chapter III

Joint recommendations of the Czech and Polish authors of the report

Data is the fuel for transformation

At this stage, data is the main fuel for the development and use of AI applications. Their quantity, quality and availability will determine the success or failure of the ambitious plans of the Czech and Polish governments regarding AI. Government declarations of high data rank for IS development are not enough. It is only through a decidedly more vigorous action on data, that our countries can achieve a greater AI-driven transformation of their public and private sectors.

Active participation in international activities

The Czech Republic and the Republic of Poland should create a much broader social and expert base for the participation of their representatives in the process of creating an international legal framework, ethical and technical standards for AI, both at the global and European level. This would result in a growth of public confidence in AI technologies.

Promoting public debate and uniform doctrinal interpretation of law

The law on AI is just emerging and will not be perfect right away. Interpretation guidance and instructions on how to comply with the law can and will in many cases remedy the initial shortcomings. In particular, official opinions of ministries and public authorities, issued after extensive public consultation, can significantly reduce the uncertainty surrounding the interpretation of legal provisions in relation to AI.

Improving general public perception

A possible way to improve the accuracy of the perception lies in encouraging the public to make judgments about the specific instances or cases of the use of artificial intelligence, emphasizing the practical level of utility and communicating the ways to eliminate the risks (ethical AI research, professional retraining for endangered professions). Providing and bringing the specific examples of the AI technology into the spotlight is likely to facilitate the discussion between individuals, and encourage them in expressing their views of that technology. This way, it is possible that the convergence between the general and specific AI cases and measures would be able to strengthen societal confidence overall.

Supporting regulatory sandboxes and data trust

Over-regulation can paralyze AI development. Therefore, the governments of the Czech Republic and Poland should inspire the creation of the so-called Regulatory sandboxes in which it will be possible to share data and research, as well as develop and test AI solutions without legal restrictions. This will encourage innovators to work on non-standard solutions and allow better adjustment of the law to the next stages of AI development.

Preparation for changes in the labour market

While digital transformation has the potential to make progress in many areas, it is also a risk to traditional low skilled jobs and increasing social inequality. Therefore, our governments should launch programs well in advance for universal digital education of societies, re-skilling and lifelong learning skills. Governments should seek to pursue a proactive, not just reactive, employment and education policy, based on careful forecasts of changes in the labour market.

New rules of social security systems

Automation will increase structural unemployment and bring about changes in the nature and organization of work. This will lead, inter alia, to threaten the employee-employer relationship, and a growing number of freelancers will lose their pension, maternity or sickness benefits. Policymakers therefore need to conduct a public debate and redefine how social security systems work in the AI era.

Education and training of new employees

The development of AI places new demands on the learning process at all levels. At the same time, AI brings new tools to education that increase its quality and effectiveness. Education systems must target new technical skills in the field of STEM (science, technology, engineering, and maths) and social skills for the 21st century. Schools and universities should immediately teach information technologies and the so-called IT thinking, including the AI phenomenon and related ethical issues.

Balanced approach during emergencies: COVID-19

During the COVID pandemic, AI has shown most of potential in the areas of public communication and traceability of potentially infectious people. The use of AI during emergency situations can be truly beneficial, but requires clear communication and a careful balance between data privacy and public health, as well as rigorous human-AI interaction. The effectiveness of AI solutions in such cases is hampered by a lack of data and resources supported on a state level, and it is unlikely that these will be addressed in time to be of much help during the present pandemic. In the meantime, extensive gathering of diagnostic data will be essential to save lives, train AI, and limit economic damage.

Support local know-how

In the Czech Republic and Poland, the private sector is clearly adopting AI technologies much faster than the public sector. In both our countries, private companies produce far more AI-driven solutions than the local economies can absorb, so they target customers and partners abroad. Therefore, they need an increase in orders from public institutions and public support so that the Czech and Polish economies are the first to benefit from the local know-how. It is important to act in a timely fashion in order not to lose the competitive edge, even in the turbulent times of COVID.

Prague - Warsaw, December 2020

Centre for International Relations (CIR) is an independent, non-government analytical centre established in 1996 which deals with Polish foreign policy and the most important issues of international politics. CIR is active in research, education and publishing, organises conferences and meetings, and participates in international projects in collaboration with similar institutions in many countries. CIR creates a forum for debate and exchange of ideas in matters of international politics, relations between states and challenges in the global world. CIR's activities are addressed above all to local-government officials and to entrepreneurs, as well as to officials of the central administration, politicians, diplomats, political scientists and the media. In 2014, CIR was again recognised as one of the best think-tanks in East-Central Europe in the study "The Leading Public Policy Research Organisations in the World" conducted by the University of Pennsylvania.

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